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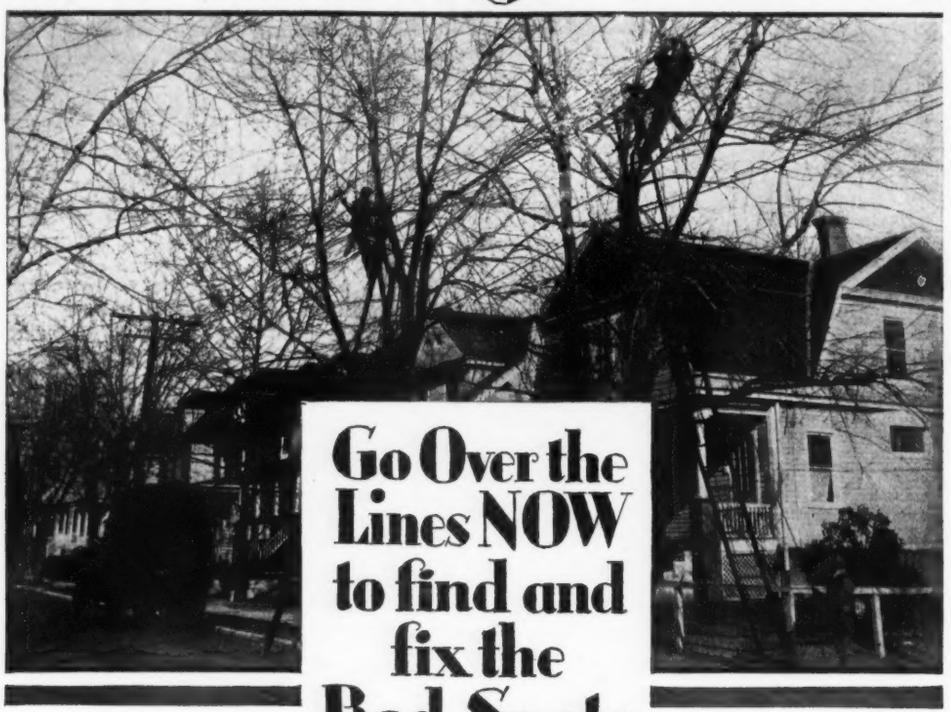
Before the Foliage Comes Again



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Stubbornness Versus Statesmanship

WHETHER water-power development on the navigable and international streams of New York will be expedited or retarded at this time depends very much on the wisdom and sagacity of Governor Franklin D. Roosevelt. Certainly, the Governor and the Legislature are desirous of putting the water powers controlled by the state to use, but under what terms and conditions remains to be seen. If politics is to prevail, nothing will be done; but if statesmanship is exercised, this tremendous waste of natural resources will soon be abated. At present the Governor and the Legislature are as far apart on the question of water-power development as the East is from the West. Both betray bitter partisanship and no outward tendency toward compromise.

Leadership naturally is expected of Governor Roosevelt and statesmanship also; but the task of reconciling two warring factions is not easy. However, we hold with Disraeli that to divert a dangerous public tendency into a safe and beneficial channel is one of the highest tasks of statesmanship. Among the pressing problems confronting New York, this question of water power stands out as one urgently in need of solution. Because of a stubborn Governor and an equally stubborn Legislature, millions of water horsepower have been running to waste for years. Society needs the power, the state needs the income desirable therefrom, and it is about time that the executive and legislative branches of the government reasoned this thing out together.

* * * *

Becoming "Merger-Minded"

OCCASIONS for legal attack upon business mergers are diminishing, according to a report upon the working of the federal anti-trust law recently completed by the National Industrial Conference Board. Restrictions upon the merging of competing enterprises are less drastic than those imposed upon interference with the business rights of others or upon collusive trade agreements, and appeals to the courts for relief against monopolization through merger have been fewer than petitions arising from other distinctive types of anti-trust cases. It is the board's conclusion that in not more than 10 per cent of the cases in which the penalties of the anti-trust acts have been invoked have industrial mergers as such been the occasion of complaint.

Scarcely a day passes in which the press of the country fails to announce merger news of interest to the electrical industry. It is a fair assumption that the public as a whole is becoming "merger-minded" in the sense of widespread recognition of the advantages of consolidation as an economic policy inseparable from the present era of mass production and distribution. It goes without saying—or should—that every merger must prove its value through competent analysis of possibilities and realized performance after the fact. Public sentiment is growingly appreciative of what mergers offer to many areas hitherto served electrically by relatively small companies with sharply limited resources, and it is apparently open-minded with respect to the extension of the principle even to first-rank properties.

It is probable that the object lessons rendered by sound consolidations in the power industry have been important factors in creating a sympathetic attitude on the part of the public toward many industrial mergers. If those behind these impressive movements continue to play the game fairly along the lines of improving service and seeking to share the economic benefits of consolidation with the public, a further development of good will toward their enterprises will be certified by popular opinion.

* * * *

Top-Rate Cuts by Commissions Represent Hollow Victories

RESIDENTIAL customers desire to buy as much electricity for their money as possible in order to enjoy the comforts of available appliances within their budget limits. Promotional rates with relatively low follow-on prices induce large use. Where such rates are properly designed, their first achievement is to lift the burden of the unprofitable customer from the shoulders of the more extensive user, at least in large measure. Their second accomplishment is to put a power rate in the home, so to speak, covering all classes of service on a one-meter basis.

In many places the objective of large use at lower unit prices has been sought by attacking the maximum rate, but the results have often proved very disappointing, because in many cases the small user has either become a greater dead weight on the system or has failed to increase his consumption sufficiently to become a profitable customer.

Speaking recently at Worcester upon domestic rate problems, Samuel Ferguson declared that it may look like a victory to have the commission and the courts decide against a company and compel a reduction, say, of 7 cents to 5 cents per kilowatt-hour, but in reality little progress toward the objective of low-cost residential service (expressed in unit prices for energy) is made in this way. There are only a few homes that can afford electric cooking, refrigeration and hot water at the reduced price any better than they could before, and owing to the fact that earnings are immediately decreased, the company's enthusiasm for giving the 2-cent or 3-cent energy rate so badly needed in the home becomes

tepid. Indeed, it may be almost impossible to establish the proper schedules because of this backward step. Many companies, because their earnings are attacked, seek to popularize themselves by lowering their maximum rate instead of introducing a true inducement system of charges. This practice, in the opinion of Mr. Ferguson, leads nowhere else than to eventual destruction. He maintained that the finding of the commission in the Worcester case, a 7-cent to 5-cent cut, set progress toward the complete electrification of the home in that city back at least five years.

There is food for thought in these remarks, because industry opinion is still in the making on the subject of residential rates. The best thought of the industry seems to be in sympathy with promotional rates, as against either voluntary or involuntary decapitations of the top rates so essential to meeting overhead costs. In this way, before putting lower energy rates into effect, liberal use can be encouraged, to the mutual advantage of customers and utility companies.

* * * *

The Evidence Exists

A LATE manifestation of the normal Wisconsin state of mind is the series of legislative committee hearings on electric utilities that have been reported in our columns and are briefly summarized by J. P. Pulliam in this issue of the ELECTRICAL WORLD. The important thing is that the hearings have given central-station companies in that state an opportunity to marshal facts and figures to support the economic and public benefits of corporate operation of utilities. A wealth of data that would be very valuable to any group of utilities called upon to present a similar case is thus available. The actual figures, of course, apply to the Wisconsin situation, but the manner of their development and presentation would be applicable anywhere. If it should ever seem advisable for the utilities to do what they are so frequently and so widely accused of doing—engage in an active campaign of propaganda against the idea of public ownership—they could find the basis for developing effective evidence almost without end in the office of the Wisconsin Public Utility Information Bureau.

* * * *

Tampering with Meters

RECENT reports tell of the arrest of a man who has confessed to tampering with no less than 95 electric meters, thereby defrauding a light and power company in the aggregate of a large sum of money. The company, the report says, is not planning any action against the dishonest customers, but will try to collect from them the money of which it has been cheated.

Possibly this course of action has been dictated by fear that a more severe course would deprive it of good will or that printed details might disclose to other unscrupulous persons methods of tampering with meters. On the other hand, it is possible that the local law is not adequate to protect the utility.

Some out-of-date laws exist which hold that the only evidence of guilt which can be accepted by the court as *prima facie* is where a culprit has been caught in the act of tampering with or bypassing a meter. In view of this fact it is in the interest of all meter-using utilities in the states concerned to unite to bring a modification of such laws, which allow theft to go unpunished. It seems obvious that if a meter inside private property is found on one visit of a meter tester to be registering all energy delivered and later it is found that the meter has been tampered with or bypassed, the occupant of the premises is either directly responsible for theft of energy or has permitted it. Under these conditions he should not only be responsible for the loss of revenue, but also liable to a penalty for his dishonesty.

* * * *

Comparable Data on Lightning Disturbances Needed

IN THE REPORT made this week by the A.I.E.E. subcommittee on power transmission and distribution it is urged that all companies that have been keeping records of transmission-line performance continue this work and that other companies having transmission lines subject to comparable storm influences keep records which can be compared. This request for data, which may cover circuit mileage, height and arrangements of conductors, use of ground wires, kind of structures, type of insulators, 60-cycle flashovers, arcing horns, number of electrical storms, number of flashovers, number of insulators damaged, and soon, should meet with response.

Such data, or any other collected, would be of value to the committee, which is making a noble attempt to recommend methods for preventing or remedying what is now the biggest bugaboo in the path of reliable transmission and distribution of power. So far the committee has been seriously handicapped by the limited amount of information submitted. The only way it can function effectively is to have at hand all possible facts.

* * * *

Company Lighting Should Be Impeccable

LIGHTING installations of power companies for their own use should set the pace for the entire community, regardless of the frequency and cost of modernization. "Uneasy lies the head that wears a crown" applies to leadership in electrical development as well as to kingdoms. By and large, company lighting in this country illustrates high standards of practice; but it is not enough to maintain a first-class average in plant, office and outdoor illumination for central-station purposes. Outstanding excellence is essential, and companies which insure this enhance their public relations along with the stimulus the best work gives to sales of lighting equipment and energy throughout their territory.

Occasionally, through press of other tasks, operating organizations fail to keep their own lighting up to "concert pitch," and sometimes initial installations are somewhat inferior in caliber. An example was recently observed which gave the impression of a down-at-the-heels community and a low grade of electric service.

The cost of bringing installations of this type up to date is too small to weigh against the bad impression which a poorly designed, carelessly installed or badly maintained job broadcasts. It is not too much to expect a progressive power company virtually to set the fashions in territorial electrical service, and if the central-station organization lags considerably behind the times in such matters, to whom indeed shall the great industrial and home-making public look for light and leading?

Moratorium on New Issues Suggested

THAT the Federal Reserve banks are to blame for current inflation of the credit structure by virtue of their open market operations—that they in reality have sanctioned the present unparalleled orgy of speculation—was charged by H. Parker Willis, formerly secretary of the Federal Reserve Board, last week, in an address before the District of Columbia Bankers' Association. Dr. Willis implies that this has placed an unwarranted handicap on business. Bankruptcies are at a new high level. The number of non-taxable income returns has grown 10 per cent in a year. As correctives Mr. Willis suggests "some temporary, partial suspension or moratorium with regard to overissues of new securities." He also urges that "the principal bankers must undertake quite definitely to reduce their commitments on purely speculative or trading account to some figure taken as basic or normal."

In substance the first of these correctives the utilities and their bankers have already employed by temporarily withholding new issues at such times as the market's absorptive qualities have been exhausted. Such a solution is better than any moratorium enforced from without. The warning as a whole, however, warrants the careful thought of the utility industry, especially as it comes from one who was so prominent in the drafting of the Federal Reserve act. Any major interference with the normal course of business cannot but be reflected sooner or later upon the utility industry.

* * * *

A Radical Development in Circuit Breakers

SOME ONE once had the very brilliant and original idea of breaking an electric circuit under oil. Ever since then power-house and substation operators have had to contend with the hazard and limitations of this inflammable medium, because no better way of rupturing large currents has been developed. Manufacturers and utility companies have conducted research on a scale costing millions of dollars to ascertain methods of overcoming the difficulties, but their success has been limited. Tanks have been made larger and stronger. Tank tops have been improved. Contacts have been made heavier and speedier, and other progress has been registered. But the magnitude of the currents that must be ruptured has been so increased by interconnection of large power sources that operators are crying out for a circuit-breaking device which can be definitely rated and which will not be limited in rupturing capacity. It has become obvious that switch designers have gone as far as they can go along old lines, and there has been a general demand that scientists should have a chance to tackle the problem unhampered by prejudices that have hitherto prevailed.

Lo and behold! the "Deïon" circuit breaker is the first radical development. It involves a principle of arc extinguishment that has not before been used commercially—no oil, no fireworks, no explosions.

The arc resulting from opening the circuit is broken into a multiplicity of short arcs which are rapidly moved by a magnetic field over closely spaced metal plates, so that a cold-cathode arc is produced which can be interrupted within one-half cycle to two and a half cycles when the current reaches zero. Units operating on this principle have been tested up to 15 kv. on three-phase grounded and ungrounded short circuits with results which are reported to compare with the rupturing capacities of some heavy-duty oil breakers. Though the apparatus is still in the development stage, the Westinghouse Electric & Manufacturing Company reports that there will be no difficulty in applying the principle up to 25,000 volts and possibly more.

Electrical engineers throughout the world will get a thrill out of the series of papers presented on the subject before the winter convention of the American Institute of Electrical Engineers and abstracted in this issue of the ELECTRICAL WORLD. The new breaker proves what science can do when it obtains a chance. It is an excellent idea and has great possibilities, but it is only one idea. Let some more scientists loose on the problem, and there will be some other ideas, perhaps even more original and better.

* * * *

The Carpet of Bagdad or Greater Wonders?

EXCEPT to physicists the recent announcement that Albert Einstein, the world-renowned author of the relativity theory, has deduced a single law to which electric and gravitational laws become subservient may have no significance. Without knowing more of his deductions than is now available, it is difficult to judge, but if what has been printed is true and indicative of the nature of the complete study, some persons now alive may live to see the day when gravity can be overcome by electrical means. What wonders may then be worked! What a new field will be open to electrical applications!

This vision may sound like that of a dreamer; yet it required only the formulation of laws of gravity by Newton and of electromagnetic laws by Maxwell and others to enable men to deal with these forces definitely and with certainty of results. Radio, telephotography and other facts of today would have seemed like dreams only a few years ago, but knowledge of laws opened nature's forces to man's control.

So what may come from a law relating gravity and electricity? Perhaps the carpet of Bagdad or some greater wonder.

* * * *

Teamwork in Sales

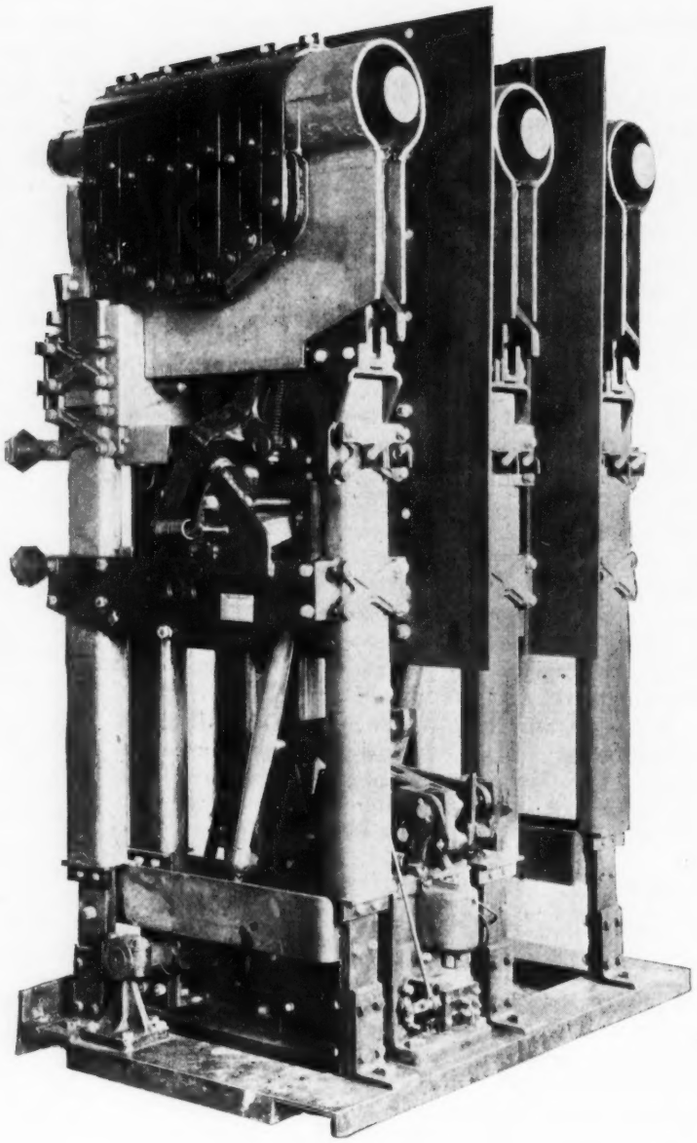
ON MANY properties there is opportunity for operating men to co-operate with the commercial department in sales work. In small communities, especially, an operating man is in direct contact with customers and often has time to do sales work on appliances without interference with his regular duties. By a sensible adjustment of costs the co-operation of operating men can be made to inure to the benefit of both the commercial and the operating department. In one case reecntly reported the cost of sales has been reduced one-half and a large increase in business has been had.

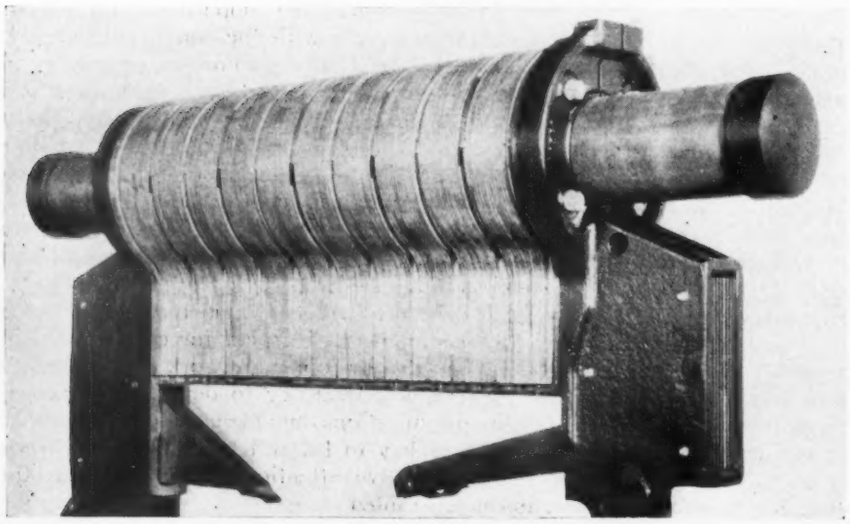
Many good salesmen will be found among operating men, and the development of a plan for co-operation in sales effort helps to develop team work among utility personnel. There is a tendency to departmentalize too much in utility organizations, and managements can utilize load building as a key to better understanding between departments. Executive attention to opportunities for co-operation is warranted.

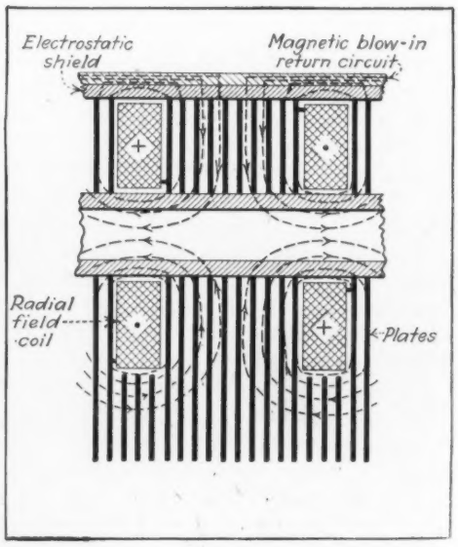
The "Deion" Breaker

A MOST interesting development in circuit breakers was discussed at the A.I.E.E. convention this week, where the theory, structural features and results of field tests were presented. In principle this new breaker consists of a stack of copper plates separated $\frac{1}{16}$ in. The arc which is drawn between contacts below this structure is blown by a magnetic field into the stack, where it is broken into a series of short arcs. In each inch of the structure there are eight cathodes with their adjacent gas layers. Because of the cold-cathode effect, the arc is interrupted within one-half to $2\frac{1}{2}$ cycles after establishment.

Units operating on this principle have been tested in the laboratory and field with some very satisfactory results. Currents as high as 25,800 amp. were interrupted without signs of distress, and the conclusion was reached that the limitations are capable of more definite determination than those of oil breakers. Papers on the subject were presented by Dr. J. Slepian, C. R. Dickinson and B. P. Baker and B. G. Jamieson, the features of which are given on the following pages.







Field Experience with
Radical Breaker Development

Results of extensive performance tests made in Chicago using the new "Deion" circuit breaker. Operation based on the rapidly deionizing characteristic of the gas film adjacent to cold cathodes

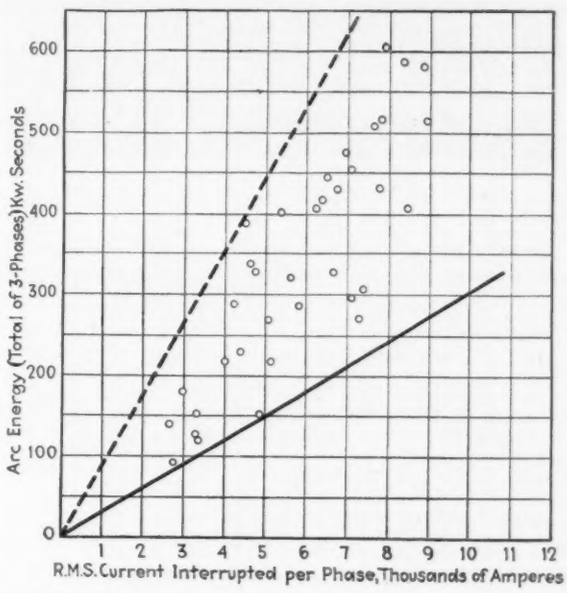
ANNOUNCEMENT of the new "Deion" circuit breaker, made during the midwinter convention of the American Institute of Electrical Engineers this week, marks an important development, the true significance of which may not be fully appreciated at the present moment. The rapid growth of interconnection and the pooling of power sources which it has brought about, coupled with the number of industries which purchase power at primary voltages, has imposed the very pressing problem of securing adequate and dependable circuit breakers. While the oil circuit breaker has assumed a commanding position, it has attained that advantage because there was admittedly no other known interrupting medium better adapted to the service, according to many power companies.

Operators have always been cognizant of the hazard involved by using large quantities of oil in connection with interrupting heavy short circuits. The examination of contacts after very severe "shorts" has almost become a necessity to assure subsequent satisfactory operation. Then there has been the uncertainty as to what magnitudes of short circuits any breaker will rupture. Speed of clearing short circuits and the effect of this operation on the remainder of the system have demanded serious attention. The effects of moisture and changing weather conditions on the oil in circuit breakers is also a problem.

Consequently power companies have been openminded toward the advent of any means of circuit interruption applicable to heavy-current circuits which would overcome any of these problems, particularly those imposed by the use of oil.

With the "Deion" circuit breaker, according to R. C. Dickinson* and B. P. Baker of the Westinghouse Electric & Manufacturing Company, an arc is drawn in air and forced into a deionizing chamber, where it is broken up into a multiplicity of short arcs which are moved over annular metal plates at a velocity sufficient to prevent burning. This movement of the arc is maintained until the current wave reaches zero, after which the arc path is deionized and the arc extinguished.

As Dr. J. Slepian,† also of the Westinghouse company, points out, the "Deion" breaker depends on the principle that the thin layer of gas immediately adjacent to cold cathodes will withstand about 250 volts before breaking down, and after being subjected to an arc acquires the ability to withstand this voltage again faster than any power system can restore the voltage. The arc space away from this zone does not deionize very rapidly. Consequently in the new breaker the space between arcing electrodes is limited to a very small amount, about $\frac{1}{16}$ of an inch, to confine the arc to the rapidly deionizing zone. Because the voltage impressed across a series of short gaps does not distribute itself uniformly it is necessary to use a static shield to compensate for this lack of uniformity. Actually a series of gaps which will withstand 6,000 volts r.m.s. unshielded will withstand 10,000 volts shielded. Since the presence of cold cathodes is essential, the arc in the new breaker is made to move over the electrode surfaces very rapidly by a radial magnetic field. Arcs of more than 20,000 amp. have thus been carried on copper electrodes for more than 0.01 second with only slight oxidation of the electrodes. Above 15,000 amp. there is evidence that arcs occur in parallel, thus reducing the arc velocity needed to prevent melting of the electrodes.



Relation of r.m.s. current interrupted by "Deion" breaker to total arc energy

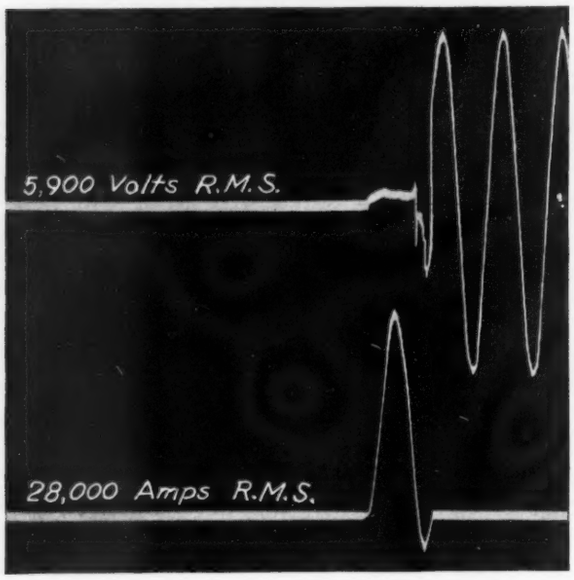
According to Messrs. Dickinson and Baker, development of the "Deion" principle has been carried to the point of building and testing circuit breaker structures up to 15-kv. ratings with rupturing capacities comparable to some present-day heavy-duty oil circuit breakers in the power house class. These breakers have been subjected to extensive laboratory and field tests, successfully interrupting three-phase grounded and ungrounded short circuits up to 15,000 amp. at 12,000 volts consistently.

The 15-kv. "Deion" circuit breaker is made up of three single-pole units, each consisting of a deionizing cham-

*"*The Structural Development of the 'Deion' Circuit Breaker up to 15,000 Volts," presented before midwinter convention of A.I.E.E.*

†"*Theory of the 'Deion' Circuit Breaker," presented before A.I.E.E. midwinter convention.*

ber, an arc-drawing mechanism with main contacts for carrying load current, and a controlling mechanism. The deionizing chamber consists essentially of a stack of thin copper plates spaced a short distance apart to form a series of gaps. Approximately 130 volts r.m.s. has been found to be a safe working voltage for each gap. The gaps are divided into groups and separated by radial field coils connected in such a way that



28,000 amp. interrupted in one half-cycle

the magnetic fields of adjacent coils are in opposition, which causes flux to be diverted radially through the gaps. The terminals of these radial field coils are so connected that they are automatically inserted in the circuit by the arc itself as it moves into the deionizing chamber.

The three-pole, 15,000-volt "Deion" circuit breaker has been subjected to 250 rupturing tests in the laboratory at currents ranging from 13,100 amp. to 586 amp. at 13,200, 7,600 and 6,600 volts, grounded and ungrounded, with both star and delta generator connections. These tests were made at an average of twelve per day, the highest number on a single day being 32. The total of 250 tests were made without a failure to clear the circuit and with very little maintenance. One hundred and fifty of these tests were made with no maintenance whatever. During the remainder, only minor adjustments were made and several of the arcing contacts were renewed. At the end of these tests the breaker was in satisfactory operating condition.

The average arc energy per interruption per pole is small in comparison to the large thermal capacity of the deionizing structure, so that the breaker is capable of withstanding much more severe operating duty than is encountered in modern applications. To investigate this, 12-CO interruptions were made at two-minute intervals in 24 minutes, with the average value of the r.m.s. currents interrupted exceeding 8,000 amp. Currents interrupted in individual phases varied from approximately 5,000 amp. to 12,000 amp. r.m.s. At the end of each one of these series of tests the breaker was in satisfactory condition to perform further interrupting duty. In all series of tests in which the deionizing structure was heated to its limiting temperature, it was only necessary to allow the breaker to cool before further interruptions could be made.

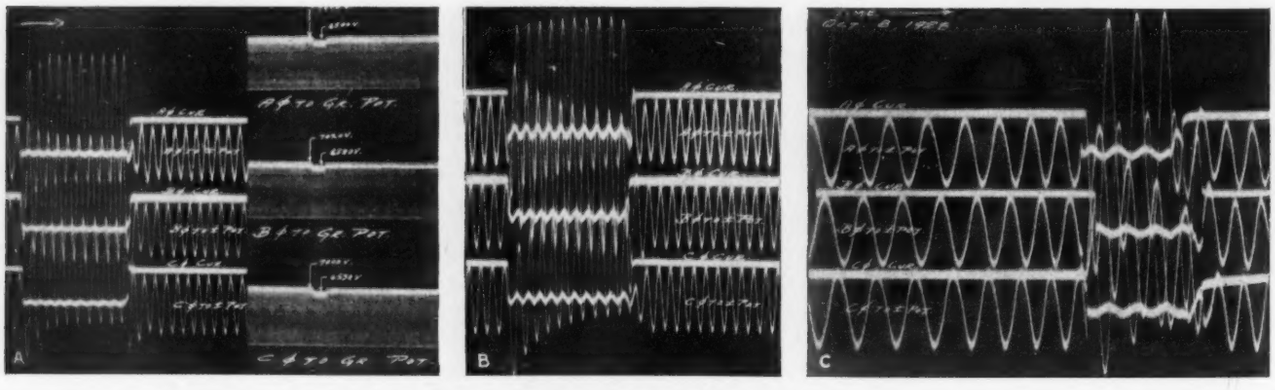
Sufficient data and experience have been obtained to make possible the extension of the "Deion" principles to a large number of different classes of commercial alternating-current switching apparatus. Industrial contactors operating on the "Deion" principle have been in service in considerable numbers for periods up to one year, operating at as high as 440 volts. A limited number of three-phase "Deion" circuit breakers have been operating under service conditions on 2,300-volt circuits for more than one year. The performance of both the industrial contactors and the 2,300-volt circuit breakers has been entirely satisfactory. Extensive tests have also been made on "Deion" circuit breakers at 4,500 and 7,500 volts, the results of which warrant the belief that they can be placed in heavy duty service without encountering serious difficulties.

There appears to be no great difficulty in extending the "Deion" principles beyond 25 kv. However, there are certain detail problems involved which are not yet worked out.

Results of Field Tests in Chicago

Because of the intense interest aroused by the development of this breaker arrangements were made for a series of tests at the Crawford Avenue station of the Commonwealth Edison Company. In what follows are presented some of the results and observations reported by B. G. Jamieson,‡ vice-president of the Commonwealth Edison Company in charge of inside plant.

‡" *Field Tests on the 'Deion' Circuit Breaker," presented before the midwinter A.I.E.E. convention.*



Rupturing currents of 4,200 to 15,200 amp.

A—4,200 amp. at 11,600 r.m.s. volts. B—15,000 amp. at 12,700 volts with group-phase breaker. C—15,200 amp. at 12,200 volts with isolated-phase breaker.

The first series of "Deion" circuit breaker tests was made with 2,000-amp., 15,000-volt, three-pole units. Tests made with this form will be referred to as "group-phase" tests, whereas tests with the single-pole units will be referred to as "isolated-phase" tests.

The test breaker for the group-phase tests had been previously subjected to interrupting duty in the manufacturer's laboratory. According to the manufacturer, this duty included currents from 500 to 9,000 amp. with voltages from 6,600 to 13,200. Furthermore, the deionizing chambers had never been disassembled since the laboratory tests, and no maintenance had been given the breaker except to install a new set of arcing contacts and auxiliary transfer contacts just previous to its delivery.

Duty Cycle Chosen

It was believed that two "OCO" operations with a two-minute interval should be regarded as a minimum requirement, but that the characteristics of the "Deion" circuit breaker would permit more latitude in the selection of a duty cycle than was practicable with the oil breaker. Besides, data were desired from which to determine the effect of a more severe duty cycle. Therefore, the 3-OCO duty cycle was used throughout the tests.

After some tests had been made, the time interval was reduced to one minute to observe the effect on the performance of the breaker, and as there was no apparent difference in performance, the remainder of the tests were made on the basis of three "OCO" operations at one-minute intervals.

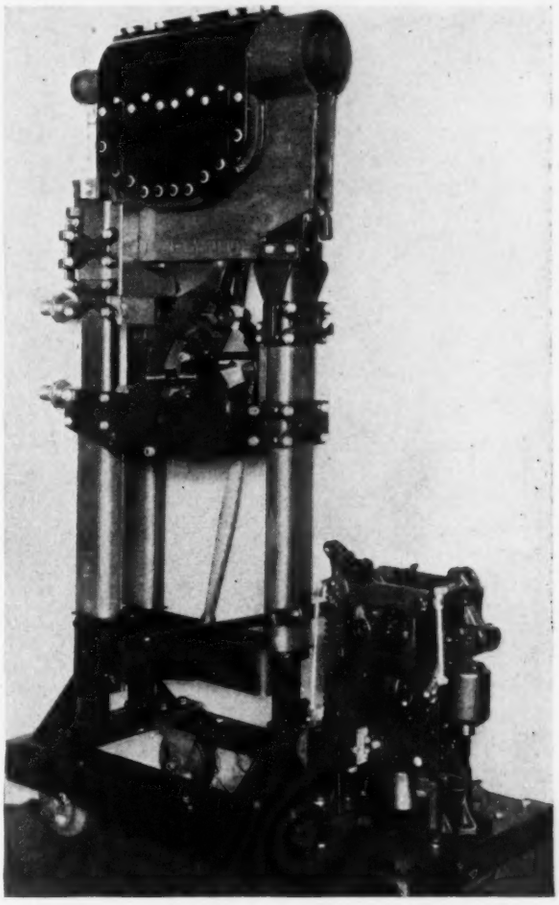
Results of Group-Phase Tests

The current value for the first interrupting test was approximately 1,100 amp.; the test is of interest as showing the interrupting performance of the "Deion" breaker at currents comparable to those involved in normal switching operations. Of the nine phase interruptions on this test, seven phases were interrupted with two half-cycles of arcing, while two phases showed arcing in parts of three half-cycles. Analysis of these results indicates that the arc is not necessarily extinguished at the first zero occurring after it originates. Apparently an appreciable time is required for the blow-in field to move the arc into the deionizing chamber, and in the event of a zero occurring during this transition period the arc is not extinguished, but persists until it has entered the chamber. The results of subsequent tests indicate that arcing may appear in parts of more than one half-cycle on any interruption, with the possible exception of very heavy currents having relatively large inherent blow-in effect.

The six succeeding tests were all made within a period of slightly less than two hours. Short-circuit current values ranged from 2,000 to 10,000 amp. in the six steps. For the eighteen three-phase interruptions in this group, in no case did any phase show arcing for more than two half-cycles and in many cases the arcing was confined to a single half-cycle. Ten thousand amperes was the highest current value obtained, using the system as a sole source of power.

Four tests were made with short-circuit currents ranging from 10,000 to 15,000 amp. One test was made approximately one-half hour after the series of six tests just described and the remaining three the next morning in a period of slightly over one hour. Of the twelve three-phase interruptions included in these four tests, eleven were satisfactory as to performance of the test breaker. On the twelfth and last three-phase interruption heavy flashing was observed on the breaker, which persisted until the circuit was cleared by a backing-up breaker. It was found that two pieces of arc-resisting material had become loosened and dropped out of the breaker. It was concluded that this material had fallen between breaker parts and established an arc outside the control of the magnetic blow-in field.

As nearly as could be determined, flashing on this test had started in the contact operating levers of



Construction of single-pole breaker tested in Chicago

phase *C* pole unit and moved to a position across the terminal studs of that phase. A short-circuiting bar had been placed across the lower studs of the three-pole units for the group-phase tests and through this bar an arc finally became established across the terminal studs of each pole unit. The breaker was still in good condition, aside from some scorching of insulating surfaces and a light deposit of carbon.

Review of Group-Phase Tests

A review of the test results obtained up to this point showed that eleven interrupting tests had been made with the breaker at short-circuit currents of from 1,100 to 15,000 amp. r.m.s., average for the three phases. Of the 33 three-phase interruptions involved, breaker performance on 32 had been satisfactory and consistent, while one was unsatisfactory, and this at a current value slightly lower than had previously been interrupted by the breaker. This demonstration of breaker performance was believed to be sufficiently satisfactory to warrant further tests employing the three-pole

Summary of Observations

Severity of Test Duty Imposed.—It was anticipated in arranging for these tests that the "Deion" circuit breaker would yield a performance on the same test duty superior to that of an oil breaker because of the absence of oil, higher speed and definiteness of arc suppression. Accordingly, the number of cycles of operating duty was increased from two to three and the time interval between cycles reduced from two minutes to one minute.

Speed of Test Program.—On the first day of the group-phase tests a total of 21 three-phase interruptions with currents varying from 2,000 to 10,000 amp. was made in a period of 2 hours 23 minutes without evidence of limitation on the part of the breaker. On the succeeding day nine three-phase operations with currents varying from 11,000 to 15,000 amp. were made in a period of one hour and nine minutes. This series of tests was ended by a disability of the breaker, which, upon investigation, appeared to be partially due to heating of the deionizing chamber.

On the first day of the isolated phase tests, twelve three-phase interruptions with currents ranging from 7,000 to 13,000 amp. were made in the period of one hour and 42 minutes. The test breaker interrupted all of these short circuits when difficulty of a mechanical nature ended this series.

On the final day of the isolated phase unit tests a total of fifteen three-phase operations with currents varying from 12,600 to 22,400 amp. was made in the period of two hours and 40 minutes. This series of tests was ended by the temperature of the deionizing chamber becoming excessively high at the beginning of the final group of tests.

Performance of Test Breakers.—Considerable difficulty was experienced in the mechanical adjustments on the isolated-phase breaker, but all of the original contacts with the exception of one remained intact throughout the tests.

Very few renewals were required for the group-phase breaker. Throughout its test there was no renewal of insulation except that following the final interruption, which was a failure due to the excessive temperature. There were no renewals of arcing or auxiliary contacts and despite the previous factory tests of the group-phase breaker the main current-carrying contacts were apparently in condition to carry normal rated current without excessive heating at the end of the Chicago tests.

Jointly the two breakers interrupted 82 short circuits. Of the 82 operations only two were unsuccessful.

Indeterminate Factors of Interrupting Capacity.—While these tests indicated a superiority of performance of the "Deion" breaker from relatively low to high current values, its performance at extremely low values such as due to magnetizing current or charging current of cables was not disclosed. This test must be made before the performance of the breaker can be compared to that of an oil breaker. Neither did the tests permit observation of the action of the breaker on closure under the maximum current duty since these values were employed only in the "CO" tests.

Limiting Factors in Interrupting Capacity.—Certain factors, recognized as determinants of interrupting capacity, were carefully observed. They are: maximum current values, resultant temperatures, mechanical strength, arcing time and restoration voltage. Of these the current values reached 25,800 amp. without definite signs of distress on the part of the breaker. Because of the rapidity of succession of the test cycles the temperatures reached a value which appeared to limit the safe interrupting capacity of the breaker. Need of mechanical reinforcement of blow-in coils was indicated. Quick restoration of voltage which is a limiting factor did not limit the performance as it does in the operation of oil breakers.

Significance of Performance.—No damage resulted to the test house or barriers or other equipment in the test circuit. There was no resultant fire, and, due to the absence of oil-throwing, the work of preparing the test cell for succeeding tests was very much expedited. The fact that practically instantaneous determination of the extent of the damage was possible should be a feature of paramount interest to all operating companies.

Another feature of interest in these tests was the extent to which it was possible to visualize the performance. In contrast to the oil breaker, witnesses at a distance of 100 yd. could judge from the flashes and irregularities in the closure or displacement of time with regard to the sequential phase operations or inequalities in amount of gas or smoke emitted. Moving pictures which were taken disclosed the presence of gas and sparks to an extent not possible with the naked eye.

Conclusions.—While the performance of the breaker must be ultimately judged from service on an operating system, the expected advantages of the "Deion" breaker were established by the test performance. Also, it appears that the limitations of the breaker are more capable of definite determination than those of oil breakers. Finally, it should be remembered that the tests were made on the first of a new type and as such they may be fairly construed to indicate ultimate results from the deionizing type of circuit breaker not possible with types having a less scientific principle of arc disposal.

units operating independently without a mechanical tie, which should simulate isolated-phase conditions.

Isolated-Phase Tests

Three single-pole "Deion" circuit-breaker units were supplied for the isolated-phase tests. These units had had no previous interrupting duty.

In the first five tests, short-circuit currents of 2,500 to 10,000 amp. were imposed on the unit. Of the fifteen three-phase interruptions involved, in no case did arcing appear on any phase for more than two half-cycles and in a great many cases it appeared in one half-cycle only.

Plate from deionizing chamber showing oxidized trail left by arc

One single-phase short-circuit test was made with the maximum current available on this set-up. No unusual features were observed in connection with this test. An effect similar to that of a single-phase short circuit was observed in several cases of the preceding three phase interruptions, in which one phase cleared slightly before the two others and one of the remaining pole units apparently did all the work of interruption, since little or no arcing appeared in the third phase. In all of these cases arcing in the second phase was confined to two half-cycles or less.

A 3-OCO test was made at a current value of approximately 13,000 amp. The test breaker interrupted the circuit each time, but some flashing was observed on phase *A* at the third interruption due to a small arc across the terminals of the blow-in coil, which in this case were quite close together. The oscillogram showed that phase *B* had functioned normally in interrupting its circuit, but that phase *A* had started to open about three cycles before the two others and that the arc had persisted in this phase until phase *C* opened and cleared the circuit.

It was concluded that breakdown across the coil terminals had deprived phase *A* of its blow-in field, resulting in a very slow movement of the arc toward the deionizing chamber, and this arc apparently had not completely entered the chamber when phase *C* cleared the circuit. The deionizing chamber on phase *A* was completely dismantled, but no signs of injury were found other than slight burning at the entrance of the chamber, evidently caused by slow movement of the arc. After a thorough cleaning the chamber was reassembled.

The next test consisted of three "OCO" operations at 3,500 amp. A single "OCO" test was then made with a short-circuit current of approximately 14,000 amp. The test breaker interrupted this circuit with arcing in parts of two half-cycles on phase *A* and with a single half-cycle of arcing on the two remaining phases. The oscillogram showed, however, that phase *A* was cleared two cycles before phases *B* and *C*. A cycle-counter test on the three-pole units with no load showed that phase *A* was opening consistently from 2 to 3 cycles ahead of the two others. Further investigation showed that phase *A* contacts were not reaching the full-closed position before the closing current was cut off by the auxiliary switches on the two other pole units, which resulted in this unit beginning to open earlier than the rest. Alterations were made in this breaker before undertaking further "OCO" tests at heavy current values.

This difference in operation, however, did not affect the performance of the breaker on the "CO" operating cycle, so all succeeding tests were made with three cycles at one-minute intervals except the first, which was a single "CO" interruption at approximately 7,000 amp. The next test consisted of three "CO" interruptions with a current value of approximately 7,500 amp. This test was satisfactory.

A series of tests was then made with five steps in current value, the first of which was 11,000 amp. The short-circuit current was then increased to approximately 13,000 amp. For the first three tests the duration of short circuit had been from seven to eight cycles. For the next two tests, this time was reduced in two steps to a minimum of $2\frac{1}{2}$ cycles in order to secure the benefit of increase in current value due to displacement. The maximum value of current interrupted on these tests was 22,400 amp. r.m.s., average for the three phases, and the maximum current interrupted in any single phase was 25,800 amp. r.m.s.

Performance Under Extreme Temperatures Observed

Performance of the test breaker had been satisfactory throughout these five steps in current value of from 11,000 to 22,400 amp. The fifteen three-phase interruptions covered by the tests had all been made within a period of four hours and 45 minutes and the last

Results of Field Tests with "Deion" Breaker

(Based on Oscillograms)

Test No.	R. M. S. Current — Initial A	Initial B	Initial C	Interrupted A	Interrupted B	Interrupted C	R. M. S. Volts — Before Test	Re-established	Arcing Period (Cycles) A	B	C
11— 7	5,820	5,100	7,300	4,440	4,120	4,230	11,600	10,800	0.500	0.500	0.445
11—19	13,000	11,000	11,700	10,150	10,000	9,740	12,000	11,600	0.500	0.334	0.445
11—27	15,700	19,700	20,300	11,500	12,400	11,700	12,400	10,200	0.445	0.445	0.400
11—31	21,700	25,100	29,600	15,400	14,100	16,200	12,700	11,300	0.450	0.330	0.330
14— 5	5,120	6,520	6,240	4,030	4,030	4,350	11,500	11,000	0.445	0.445	None
14—11	8,740	9,340	8,620	7,760	7,300	7,780	11,700	12,200	0.334	0.665	0.334
14—31	22,000	14,400	20,600	11,600	11,000	11,400	12,800	11,300	0.443	0.521	0.626
14—43	22,000	25,400	25,600	14,200	15,900	15,600	12,200	11,800	0.500	0.500	0.700

twelve interruptions were made within a period of one hour and 40 minutes. Due to the rapid interruption of heavy currents, the deionizing chambers had become very warm and it was decided to make an additional test with the same set-up in order to observe the breaker's performance under extreme temperature conditions within the deionizing chamber.

Of the three interruptions on this test, the first was normal and the second not greatly abnormal, but on the third interruption very heavy flashing was observed on all phases and this flashing persisted until the circuit was cleared by other apparatus. Inspection showed that an arc had been established between opposite potentials in the contact operating levers of all pole units and had apparently persisted there until the circuit was cleared. Insulating surfaces were badly scorched and there was a considerable deposit of carbon, but otherwise the breaker was not seriously damaged.

The oscillogram for the third interruption showed that the short-circuit current value at the time the breaker started to open was slightly less than 15,000 amp. r.m.s., average for the three phases, or about 67 per cent of the current value successfully interrupted on a test shortly before this. In view of this fact, and of the results of the preceding tests, it was concluded that this last test had demonstrated a limitation of the "Deion" circuit breaker, not in maximum current rupturing ability, but in the severity of the operating duty to which it may be subjected.

Wiring Conduit with Compressed Air*

By H. G. Hall

Assistant Superintendent Underground Lines Department, Detroit Edison Company, Detroit, Mich.

THE increasing use of underground cable has led to the development of numerous labor-saving devices and methods to reduce the cost of installation. While the preliminary threading of the conduit represents no large percentage of the cost of pulling a cable, devices for accomplishing this operation have been numerous and varied. However, the jointed push rod has been the standard equipment of most utilities and has withstood the test of time. The development of portable air compressors now makes it possible to thread a No.12 gage galvanized-iron wire into certain type of conduit at one-fifth the cost and five times the speed of the push-rod method. This is accomplished by attaching the wire to a "bullet" propelled by compressed air.

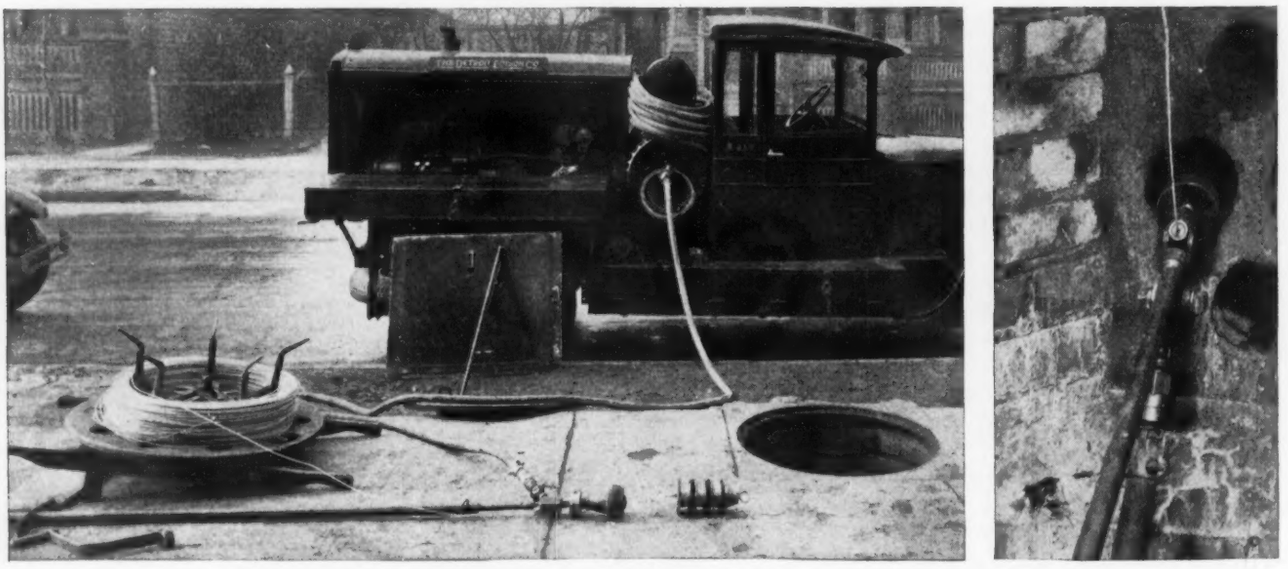
Soft-Rubber Projectile Carries Fish Wire

The "bullet" developed by the writer consists of a series of soft rubber washers alternated with aluminum spacers, both being mounted on a metal rod having an eye in each end. The rubber washers are slightly larger in diameter than the conduit and the aluminum spacers are about 2 in. smaller than the diameter of the conduit.

A plumber's test plug is used to seal the conduit. To this is added fittings for connecting the compressed air, a throttle valve for quick control of the air, an orifice through which the wire is threaded and an adjustable support to be braced against the opposite wall of the manhole to prevent the test plug from blowing out should the air pressure build up too high. With a pressure of 50 lb. at the plug, the bullet and wire will travel approximately 400 ft. per minute in well-laid fiber duct. This method is adaptable to all types of closed-joint conduit. Loose-jointed conduit, such as clay tile, if laid up in banks without concrete separation, permits the air to escape through the joints at such a rate that sufficient pressure cannot be maintained to propel the "bullet"; then rodding must be resorted to.

This method of wiring conduit has the further advantage of cleaning the conduit of mud or loose stones, gravel, etc., and manhole equipment, which must be lagged to the manhole walls on new conduit runs, may be installed at the same time with the aid of compressed air tools. Obviously, the more conduits in a bank wired at one time the greater the saving, as there is a minimum of lost time consumed in moving from manhole to manhole.

*Editor's Note.—*The equipment described here is a refinement and improvement of the device which was the subject of an article by R. L. Dodd, general foreman of the underground division of the Milwaukee Electric Railway & Light Company, in* Electrical World, *June 23, 1928, page 1334.*



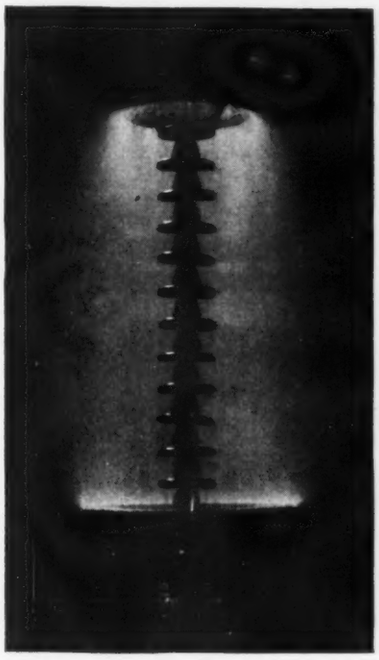
Equipment for threading conduit and projector in place in manhole

Lightning Protection Analyzed

Results of field investigation and laboratory research made to simulate service conditions. Individual as well as committee observations and recommended practices

PROGRESS made recently in analyzing the lightning problem by theoretical investigation and laboratory and field research lead to some almost radical changes in the preparations for combating it, according to papers presented before the midwinter convention of the A.I.E.E. this week. The acquired knowledge regarding this phenomena and absorption of steep-front traveling waves gives hopes that more effective and reliable lightning arresters than any on the market to date may be developed.

In research the problem has been attacked from the voltage angle plus the knowledge of how, in some instances, the induced traveling high-frequency waves will be propagated. By means of the cathode-ray oscillograph and the klydonograph field experience has been recorded and reproduced as near as possible in the laboratory to secure data unobtainable in the field. While there is much to be learned, lightning investigation is at least on an engineering basis.



Protective rings spilling over from lightning impulse

From records of transmission circuits of one company the number of circuit outages in 1927 was slightly reduced over the number the year before. These results were claimed to prove the effectiveness of the ground wire, the possible greater effectiveness of two ground wires properly arranged and the value of arc-protective devices to minimize cascading when flashovers occur.

Considerable research is planned this year in the field and laboratory and there are prospects of securing some very illuminating information.

Progress in Research

By combining research in the laboratory and field, F. W. Peek, Jr.,* General Electric Company, points out, the wave shape of lightning has been pictured by the cathode-ray oscillograph; the time required for a cloud to discharge has been measured by the cathode-ray oscillograph; the attenuation of lightning waves traveling on a transmission line has been determined; natural lightning waves have been reproduced in the laboratory, where their effects on transmission lines, insulators, insulation, transformer and protective apparatus have been studied; a lightning generator producing over 3,600,000 volts has been constructed and waves from this generator have been sent over transmission lines to test full-size transformers and other apparatus to determine how to make them highly resistant to lightning; scientific work on the time lag of gaps and insulation has been extended, etc. An extension to laboratory facilities is now available so that about 5,000,000 volts is obtainable. Due to reflection double the generated voltages have been observed at the ends of transmission lines. Waves ranging in duration from a few microseconds to a thousand microseconds and involving about 14,000 watt-seconds have been experimented with.

It is interesting that the cathode-ray oscillograms measuring time in microseconds check the early work. The wave reaches its crest in a fraction of a microsecond and then decays to half value in five microseconds.

With the exception of gaps between electrodes producing a uniform field the lightning or impulse sparkover voltage is always appreciably higher than the 60-cycle sparkover voltage. The steeper the wave or the shorter the duration of the transient the higher the crest sparkover voltage. With an exceedingly steep or short wave there may even be a measurable increase for spheres. The lightning breakdown voltage will thus vary because lightning surges vary. The ratio of the lightning to the 60-cycle crest sparkover voltage is always greater than unity.

Under the usual severe lightning conditions in practice, insulator sparkover voltages give an impulse ratio of two. This has been well established by comparing the lightning sparkover voltages of insulators as measured in the field by the surge voltage recorder and the klydonograph with the 60-cycle sparkover voltage. The impulse ratio is thus an indication of the effective duration of the wave.

An important development is the grading shield for insulators. It bears about the same relation to the insulator string as the ground wire does to the line. By distributing the voltage more uniformly along the string it strengthens considerably the insulator surfaces against lightning and forces the arc to take place between the rings which may be set for lightning sparkover voltage higher than that of the non-shielded string. Destructive cascading is thus prevented.

The insulating value of a wood pole to lightning voltages has been measured up to 3,600,000 volts. It has been observed that the strength of the wood with varying degrees of wetness and dryness ranges from 100 to 300 kv./ft. When the length of wood in series with an insulator is not over 10 ft., 75 to 100 per cent of the insulator flashover voltage may be considered as added to that of the wood to comprise the total pole insulation. Protection from splitting can be afforded by using a lightning rod connected in series with a gap. Whether

*"Progress in Lightning Research," presented before midwinter convention of A.I.E.E.

a pole is wet or dry makes very little difference on the lightning voltage necessary to cause complete flashover. However, when a pole is quite wet, incipient sparks will take place over the insulator string at voltages approximately equivalent to the lightning sparkover voltage of the insulator string above.

Tests made on models in the laboratory show that the bus structures of outdoor stations should be of material assistance in reducing transient voltages. Grounded steel work acts as a very effective ground-wire system which may reduce induced voltages very considerably. As low as one-third voltage will occur when bus structures are added. The massed capacity effect of the bus prevents high-voltage reflection. Several extra ground wires of a half mile or more in length extending out from a station should, because of reduction in surge impedance, be very effective in reducing the voltage of incoming waves. On the other hand, tests show that the omission or reduction of ground wires at the station causes voltage rise.

Characteristics of Lightning

Voltage — order of 100,000,000.
Current — order of 100,000 amp.
Energy — order of 4 kw.-hr.
Power — order of thousand billion horsepower.
Time — order of a few microseconds.
Gradient at breakdown 100 kv./ft.

Time for cloud to discharge from one to ten microseconds.

Discharge generally non-oscillatory. Total energy dissipated in world by lightning, approximately 1,200,000 kw. continuously.

High-voltage waves of few microseconds front and 1 to 20 microseconds effective duration.

Low-voltage waves of much greater duration.

Current in line for high voltage, 2,000 to 5,000 amp. Voltages non-oscillatory. Attenuation very rapid.

Breakdown voltages higher than 60-cycle and impulse ratio for average high voltages—two.

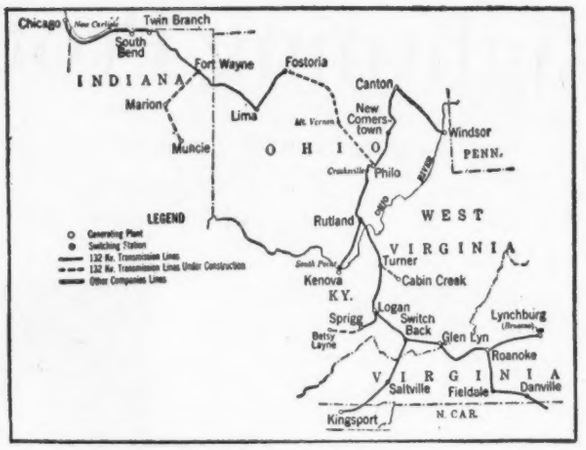
Voltage increased directly as height of line—usual ground wires reduce to about one-half. Maximum voltage $V = g \alpha h$ but limited by lightning arc-over of insulator.

Transformer insulation should be stronger than adjacent line insulation.

Approximate lightning proof line seems feasible.

Research on protection of full-size transformers has been made by applying artificially produced lightning waves over a line insulated in the usual way and then adding line insulator units until the bushings spark over or the internal insulation fails. If failures occur internally, the weak points are then strengthened until the flashovers occur on the bushings.

Cathode-ray oscillograms show that, in the usual transformer, the voltage distribution is not constant, but varies with steepness and duration of the impulse or the frequency of the transient. The ideal transformer would be one in which the voltage distribution is the same for all frequencies and wave shapes. Fortunately it has been possible to accomplish these results by shielding.



A section in which field studies were made

Steep-front waves were impressed on the 220-kv. line of the Pennsylvania Power & Light Company with interesting results. The front of the wave practically reached its maximum in 5 microseconds, decreasing to half value in 20 microseconds and reaching zero in 40 microseconds. Oscillographic study of lightning surges on actual lines is to be continued.

It is reassuring that the research done during the past year tends to confirm and clarify what had already been done. For example, addition of ground wires reduces the surge and in turn the voltage of traveling waves. Thus it is important to bring all ground wires up to the steel bus structure or station. Extra ground wires extending about half a mile from the station should be of great value for station protection.

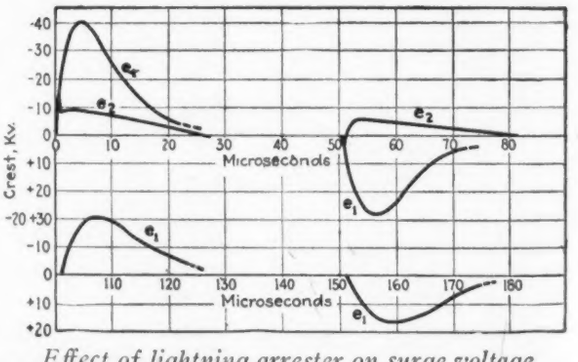
Experiments on 132-Kv. Lines

Reviewing 1927 experience with the 132-kv. lines of the American Gas & Electric Company, Philip Sporn† reported as follows:

The effectiveness of the ground wire was shown by the low voltages recorded on the ground wire at the time of surges. About 20 kv. maximum was recorded, which is small in comparison with the line lightning voltage. Its effectiveness is further indicated by the relative voltages recorded on the three phases. Some data were obtained that would indicate very definitely the effectiveness of two ground wires where properly employed.

Ground wires equalized the lightning voltages on all three wires of a vertically arranged line, besides reducing

†*"1927 Lightning Experience on 132-kv. Lines of the American Gas & Electric Company," presented at midwinter A.I.E.E. convention.*



Effect of lightning arrester on surge voltage
Oscillographic records show e_1 with line open, e_2 with arrester.

the lightning voltages. Where one wire was employed, if equalization did not result, it was in the direction of reducing the lightning voltage on the top and middle conductors to a value below that on the bottom conductor where the ground wire was placed immediately above the top wire.

Use of properly designed arcing protective devices has in all probability resulted in a certain reduction in the number of flashovers, and has very definitely minimized cascading where flashovers finally resulted.

The two-circuit line having its circuits arranged vertically on the same tower has shown itself to be very reliable from the service point of view.

The localization of damage in case of flashover confirms very definitely the field data obtained by klydonograph and indicates a very rapid attenuation of surges.

On some of the lines 2,100 kv. was recorded in the klydonograph investigation with a resulting line outage. On the other hand, a recorded voltage of 1,450 kv. resulted in no line outage. This tends to confirm laboratory tests made with artificial lightning applied to insulator strings.

Dry pole flashing over at high voltage

As a result of previous years' experience, careful attention to the line-entrance problem was continued whenever a new substation was built and the ground wire was brought into the station structure. The practice of using grading rings on insulator strings and of reducing the insulation for a mile or so on each side of a station was continued. Instead of using a ring at the bottom of insulator assemblies and a horn at the top a ring is used in both positions now. Further stress was laid on reducing the average span and the use of a single ground wire was continued, although two ground wires were employed in some special cases. In every case where two ground wires were not employed provision was made for the installation of the second ground wire if operating experience continues to check its beneficial effects.

Committee Observations and Recommendations

Basing its comments on data obtained so far the power transmission and distribution subcommittee‡ of the A.I.E.E. reported that the following inferences may be drawn:

Properly installed, an overhead ground wire materially increases line reliability by reducing flashovers due to lightning. In general, points of higher elevation along transmission lines are more subject to flashovers than those of lower elevation. Flashovers on lines equipped with ground wires are more likely to develop at structures where the value of the earth resistance is high, especially if materially above 50 ohms. Earth resistances vary widely, making tests necessary if reasonable assurance as to their probable values is desired. In practice the installation of multiple ground wires on a transmission line appears to check theory, affording greater protection than a single wire.

Shattering of wood poles and crossarms is greatly reduced by properly installed overhead ground wires and also by bonding and grounding all hardware at every pole. Special construction may be resorted to with expectancy of reduced lightning outages on wood pole lines.

The use of fused grading shields offers promise of reduced outages due to flashovers, and materially improved operation should result when more reliable fuses are developed.

This subcommittee made the following recommendations:

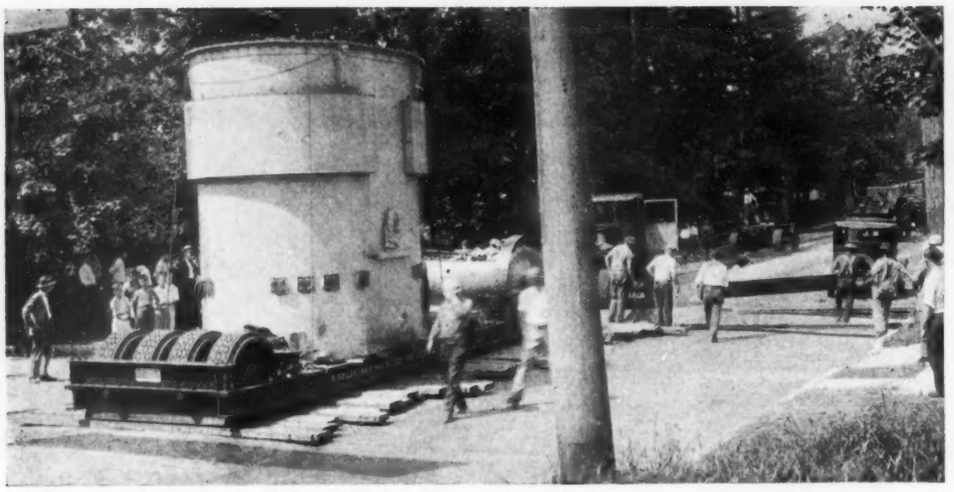
1. Use of overhead ground wires.
2. High-conductivity ground wires using steel-core copper or aluminum conductor.
3. Mechanically sound installation of the ground wires with flexible supports.
4. Ground wires connected to each steel tower and to ground at least every thousand feet on a wood tower line.

‡*Report submitted to midwinter convention of A.I.E.E.*

Performance of Eighteen 132-Kv. Lines of American Gas & Electric Company 1926 and 1927

Length of line (miles)	65.0	30.0	45.6	128.5	21.0	73		15.4	118.7	65.0	43.0	50.3	56.0	50.0	46.0	40.2	4.9	55.0	40.0
Number of circuits	2	2	1	1	1	2		1	1	1	1	1	1	2	1	2	2	2	1
Number of ground wires	1	1	1	1	None	1		1	1	1	1	1	1	1	1	None	1	2	1
Rings and horns	No	Yes	No	Yes	No	Yes		No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No
1926							1925 1926												
One circuit only out	16		9	23	3		13	3	11	0	13	3				16	0	9	..
Both circuits out	4		..	..	..		2	..	..	..	..	..				2	0	2	..
Total outages	20		9	23	3	88	15	3	11	0	13	3				18	0	11	..
Circuit outages for 100 miles of line per year 1926	48*	0†	19.8	17.9	31*	120	20.5	19.5	10.6*	0*	36.6*	6.3*	0†	0†	0†	44.8	0	20	..
Circuit outages per 100 miles of circuits per year 1926	24*	0†	19.8	17.9	31*	60	10.3	19.5	10.6*	0*	36.6*	0.3*	0†	0†	0†	22.4	0	10	..
1927																			
One circuit only out	21‡		4	8	7	3‡		1	7	16	16	7	..	..	..	20	1	2‡	4
Both circuits out	3		..	..	..	1		..	..	..	..	..	..	..	..	4	1	0	..
Total outages	24	0	4	8	7	4		1	7	16	16	7	..	..	..	24	2	2	4
Circuit outages per 100 miles of line per year 1927	37	0*	8.8	6.2	33.3	5.5		6.5	5.9	24.6	37.2	13.9	0*	0*	0*	57.2	41	3.6	10.0
Circuit outages per 100 miles of circuit per year 1927	18.5	0*	8.8	6.2	33.3	2.8		6.5	5.9	24.6	37.2	13.9	0*	0*	0*	28.6	20.5	1.8	10.0
Recapitulation																			
Damage to insulators	17	1	7°	28°	0¶	0		0	2	14	2	0	0	0	0	2	1	0	1
Damage to conductor and hardware	14	3	5	0	0¶	3		0	1	5	7	0	0	0	0	4	0	0	0
Total cases of damage	20	3	9	28	0¶	3		0	2	14	7	0	0	0	0	5	1	0	1

*Corrected for one calendar year (in service only part of year).
†Not in service.
‡One circuit out of service at the time of F. O. in one case.
¶Superficial inspection—Towers not climbed.
°Probably partly accumulation of two previous years.



In spite of high concentration of weight and grades as great as 12 per cent this 72-ton oil-filled transformer was delivered by highway

Transport 72-Ton Transformers Over Highway

By Oscar Bauhan
Engineer Public Service Electric & Gas Company, Newark, N. J.

UNUSUALLY difficult conditions were encountered in transporting the seven 72-ton oil-cooled transformers for the new West Orange switching station of the Public Service Electric & Gas Company up the Orange Mountain from the point of railroad delivery. The station is equipped with six 18,500-kva., single-phase, 132/26.4/11-kv. O.I.S.C. transformer units with one spare. The weight of each completely assembled unit with oil is approximately 95 tons and that of the core and coils submerged in oil in the bottom section of the tank is approximately 72 tons.

The nearest railroad siding is approximately 8,000 ft. to the east in the center of the town with a 460 ft. difference in elevation between the site and the railroad siding. This difference in elevation is confined to a distance of 6,000 ft. The minimum grade on this hill is 4 per cent, the maximum is 12 and the average is 7.7 per cent.

The rigger who contracted to deliver these transformers had a special 100-ton trailer built with eight rubber-tired wheels, each having a tread of 14 in. The contract for delivery was based on the rigger's ability to move the units continuously up the hill by means of tractors and trucks. Permission to move the units on the highway was denied by the county highway department since the allowable load per linear inch of tire tread was fixed at 800 lb., while the actual load to be moved, including the weight of the trailer, was 1,875 lb. per linear inch of tread. It therefore became necessary to reduce the loading to the allowable limit. This could be done by untanking the core and coils and transporting them separately, increasing the number of wheels on the trailer or to plank the road in some way to distribute the load.

As the first method, besides requiring the construction of adequate untanking facilities at the railroad, would in all probability have made necessary the drying out of the core and coils on arrival at the site and as this would have meant considerable expense in providing adequate power facilities, since the station was not as yet energized, and as drying out by means of stoves was not considered because of the time that probably would have been required to bake out seven units this plan was discarded. The addition of wheels to the trailer did not seem advisable since it would have meant considerable reconstruction of the trailer itself. It was finally decided to use the last method, even though the tractive equipment available was not entirely adequate to stop and start the load on the hill to permit the laying of planks. Three tractors and one truck were used in the whole operation. One tractor was placed immediately ahead of the transformer and was equipped with a log chock suspended from the front axle. This tractor served as a partial brake for the trailer as well as for tractive effort. The remaining two tractors and the truck were used for moving the transformers by means of block and tackle.

Due to the delay caused by experimentation in methods of planking the road, and in trying to find the most satisfactory means of pulling the trailer as well as making frequent changes of tackle, two weeks were required to complete the moving of the first unit. The second unit was delivered in one week. The time taken for each succeeding unit was in each case less, so that the time for delivery of the seventh unit was brought down to three days.

Telephone Cable Capacity Increased 50 per Cent

RECENT developments in the methods of constructing telephone cables permit the use of 1,818 pairs of wires in "multiple-unit" design. The diameter of the cable sheath is 2§ in., the standard for full-size cable, and the pairs are arranged, for convenience in splicing, in eighteen units of 101 pairs each. The largest previous telephone cable contained 1,212 pairs. This new cable was developed by the American Telephone & Telegraph Company.

Defects of Straight-Line Rate

Graphical contrast with promotional form of rates for domestic service. Equitable distribution of costs, returns and development of business obtained with modern rate forms

By C. F. LACOMBE and W. S. LEFFLER
Consulting Engineers, New York

THE charts shown in this article depict the defects of the straight-line rate for domestic service and show in dollars the relative proportions of loss and gain under a straight-line rate, with the results of a reduction in this rate and a solution of the problem of changing to a promotional form of rate to obtain domestic business.

The straight-line rates referred to in this article are those having the straight-line effect on prices, whether of the pure type or of the broad block, step or demand variety of the rate.

This form of rate was useful in the sale of lighting service in periods now past, but when applied to the development of domestic service in the present becomes inadequate, defective and even dangerous.

Its inherent characteristics are well known, it is uneconomic and inequitable; uneconomic because, as shown by the charts, it does not follow even remotely the cost curve of domestic service. In consequence, it gives no opportunity of meeting the demand for domestic electric service by reducing the unit cost with increasing use. It does not recognize the lower cost of service developed per unit by increased output.

The straight-line rate is inequitable because it charges the losses made through the smaller customers of 5 to 20 kw.-hr. a month, inevitably large under such a rate, to the more liberal users.

The rate is inadequate because it offers no means by which to compete with alternative methods and obtain domestic service.

The rate is dangerous because it cannot be reduced, assuming no changes in cost, and maintain its form without increasing the number of small customers served at a loss. If the rate is arbitrarily reduced by a commission, which is not infrequent, the loss is serious as shown in Fig. 2. The rigidity of the rate prevents such losses being regained, except very slowly.

As the use of promotional rates instead of straight-line rates is increasing with some rapidity at this time comparisons between communities using the two different rates is becoming more frequent and is dangerous, particularly when accentuated by national advertising campaigns and intensive selling of ranges, refrigerators and other of the larger electric domestic appliances.

Maintenance of straight-line rates also prevents the sale of major appliances because they make it too expensive to use them. In consequence these rates delay the mass production which would enable the first cost of these appliances to be reduced so more could be sold.

MULTIPLE METER RATES NOT A SOLUTION

Two- or three-meter rates are no real solution of the problem of the straight-line rate. They only increase the investment costs of the company and the customer and also increase the expenses of both. As lighting is billed on the high rate of the two- or three-meter rates, increased lighting and the use of small appliances are discouraged in the early stages of the development of a domestic service customer.

When, due to normal growth, a company wishes to reduce its revenue by decreasing its prices, cutting the straight-line rate and so continuing the form of the rate is the least beneficial way to do so, both for the company and the community served. The result desired by a reduction is increased use. It is known that decreasing the top step causes the least increase in usage of any

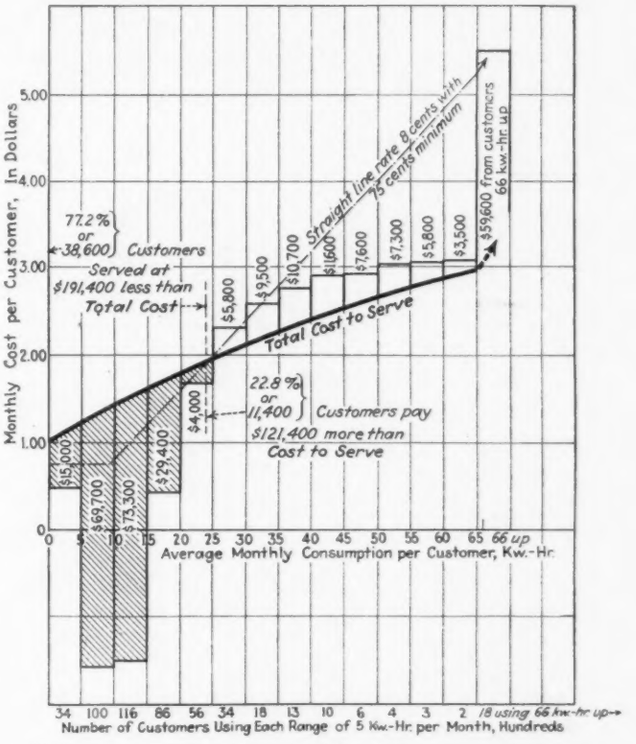


Fig. 1—Typical straight-line rate showing profit and loss for residence customers

This chart shows the uneconomic and inequitable result of a straight-line rate of 8 cents per kilowatt-hour, 75 cents monthly minimum, applied to 50,000 residence customers. The return on the total residence investment is 6.5 per cent. 38,600 customers, or 77 per cent of the total, are served at an annual loss of about $190,000. The remaining 11,400 customers are being overcharged by approximately $120,000, with a net result that the class as a whole is earning $70,000 less than the amount necessary to return 8 per cent on the total residence investment. The effect of the deficit is to reduce the class earning to 6.5 per cent, which is uneconomic from the company's standpoint, and the inequitable distribution of profits and losses as between the smaller and larger customers is obvious. Peter is paying for Paul.

Increase in consumption develops very slowly under the straight-line form of rate, which means that several years might elapse before the increased usage at this rate would bring the return on the class up to 8 per cent, and, as shown in Fig. 2, a forced rate reduction of ½ cent or 1 cent per kilowatt-hour in the meantime would postpone almost indefinitely the time when a normal rate of return might be expected.

method of reduction. In consequence, an unnecessarily long period must elapse before the revenues return to a point where rates can be again lowered. On the other hand, the introduction of a promotional form of rate designed to offer the decrease it is desired to make will give this reduction by lower second and third steps in the rate but retaining the original price necessary for the first block of kilowatt-hours.

This form of reduction is fruitful in steady and material increases of consumption and revenue and it can be used so that a cycle of regenerative reductions and increases in usage can be established and continued which will be reciprocally of great and increasing benefit to both the company and the community.

Description and Form of Charts

The accompanying charts show graphically the facts that have been stated in the foregoing as to the characteristics of the straight-line rate and its comparison with the modern promotional type.

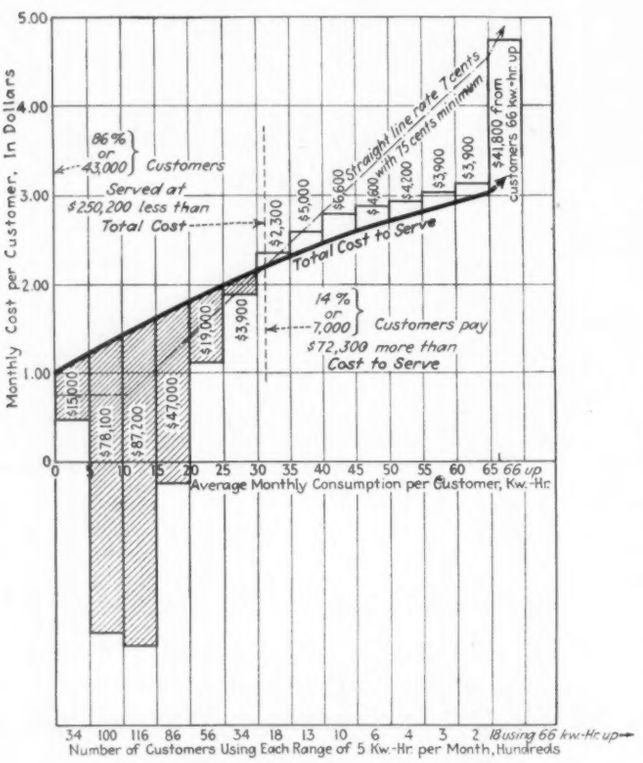

Monthly Cost per Customer, In Dollars
5.00
4.00
3.00
2.00
1.00
0
86 % or 43,000 Customers Served at $250,200 less than Total Cost
Total Cost to Serve
Straight line rate 7 cents with 75 cents minimum
$41,800 from customers 66 kw.-hr up
$15,000
$78,100
$87,200
$47,000
$19,000
$3,900
$2,300
$5,000
$6,600
$4,600
$4,200
$3,900
$3,900
14 % or 7,000 Customers pay $72,300 more than Cost to Serve
0 5 10 15 20 25 30 35 40 45 50 55 60 65 66 up
Average Monthly Consumption per Customer, Kw.-Hr
34 100 116 86 56 34 18 13 10 6 4 3 2 18 using 66 kw.-Hr up
Number of Customers Using Each Range of 5 Kw.-Hr per Month, Hundreds

Fig. 2—Effect of reduction on straight-line rate

This chart shows the dangerous and uneconomic result of a straight-line reduction maintaining the straight-line form; in other words, a reduction of the highest price of a straight-line rate form from 8 cents per kilowatt-hour to 7 cents per kilowatt-hour. It reduces the return from 6.5 per cent to 4.05 per cent. The effect is most apparent in the immediate increase of the losses due not only to the decrease in price but also due to the greater number of customers to whom it applies. Some of the Peters become Pauls. The former gains are decreased, first, by the price reduction and, second, because of the fewer number of customers remaining in the profitable class. Whereas only 38,600 customers were formerly served at a loss, there are now 43,000 served at less than cost. The annual deficit sustained in serving unprofitable customers has increased from $191,400 to $250,200 and the excess profit from the overcharged customers has decreased from $121,000 to $72,300. The net result is that the loss from the residence class as a whole has increased from about $70,000 to $180,000.

They demonstrate by a novel form of presentation the relative losses and gains in dollars under the two different forms of rates, by blocks of customers of varying consumptions in the residence class. This will be seen to be of great value, if correctly designed from complete data, as showing at once for any rate form, without further calculation, just what the losses and gains in money are of the different customers graded by blocks of usage.

It may be said here that one cannot compare a straight-line rate arbitrarily established with a promotional form of rate properly based on the use of the customers' demand because the two rates have entirely different bases. That may be true, but results under each rate can be compared and the defects and dangers of the straight-line form can be shown.

As shown in the first of the charts mentioned, it is at once apparent that a straight-line rate will not encourage the use of electricity for domestic service as well as a promotional rate because it does not pretend to compete with alternative sources of service to the home. In the higher ranges of kilowatt-hour consumption required by major domestic appliances the costs of usage become prohibitive. It has been difficult to demonstrate these faulty conditions formerly without an elaborate series of tables and charts.

The simple charts presented here show the facts so clearly that he who runs may read. Figs. 1, 2 and 3 give a striking presentation of what happened under the straight-line form of rate as contrasted to the more equitable results of a service, room, area or demand form of promotional rate.

The same bases have been used in the first three charts so they are readily comparable. Fig. 1 depicts the characteristics of a straight-line rate at 8 cents per kilowatt-hour. Fig. 2 shows the effect in increased losses when this rate has been reduced by straight-line reductions to 7 cents per kilowatt-hour. Fig. 3 presents the result of applying a service charge form of rate of the service, area, room or demand type, instead of maintaining the pure straight-line form. These rates, it may be said, only apply below 50 or 75 kw.-hr. monthly consumptions or in a variable zone around 50 to 75 kw.-hr. In this zone, to encourage increasing usage, the full promotional form of rate must begin to be available and will then carry on down to the lowest rate per kilowatt-hour quoted, which can be justified by the analysis of costs. Fig. 4 illustrates the application of the type of rate shown in Fig. 3 in conjunction with a full promotional rate based on demand, carrying the rate on to meet increasing usage resulting from major appliances. This chart is really the complete solution of the problem and, as it is easily seen, applies what might be called a rate in two parts, one for small and one for larger usages with one meter, the second part of the rate coming into action when the other no longer meets the situation. The customer passes on automatically to lower prices per kilowatt-hour as they are earned by his increasing consumption.

The Charts in Detail

The ordinates of these charts show monthly cost to serve and revenue per customer. The abscissas show average monthly consumption per customer. In each of the three charts the same cost curve is used and is designated "Total Cost to Serve." This curve is determined from two consecutive yearly cost analyses of a particular situation in which the investment and operating expenses per customer were determined for each group of customers, classified according to their average monthly consumption in groups of 5 kw.-hr. from 0 to 75 kw.-hr. average monthly consumption.

With all components of operating expense known, 8 per cent return on the investment per customer in each group was added, together with due allowance for income, franchise and other taxes. In each chart the particular

rate under discussion is superimposed on the cost curve. Where the rate or revenue curve crosses the cost curve, the customers having that consumption are earning exactly 8 per cent return on their investment responsibility. Where the rate curve is below the cost curve, the customers are being served at less than total cost.

Knowing the number of customers in each group, the annual loss sustained in serving each group can be determined. These losses plotted in proportionate areas are shown in shaded blocks below the cost line. Similarly, where the rate curve is above the cost curve, the annual profit in excess of 8 per cent return can be computed and these amounts are shown in white blocks above the cost curve.

Having located the source and amounts of profit and loss, it is obvious that if the summated losses are greater than the total profits above 8 per cent, then the class as a whole is earning less than 8 per cent return on the total investment dedicated to the class. Similarly, as in Fig. 3, if the rate form is such that the losses just about balance the profits, then the class under that rate form would earn about 8 per cent return.

These charts are supported by an analysis of costs which was so conducted that very few arbitrary allocation percentages were used in determining the final cost to serve, with the result that any component of cost, namely, customer, readiness to serve, energy or income expense can be presented in a forceful and convincing manner to commission or layman.

The customer progresses naturally from the low fixed charge, higher energy price of the first rate into the higher fixed charge, lower energy charges of the second rate when the reduction has been earned by the use of

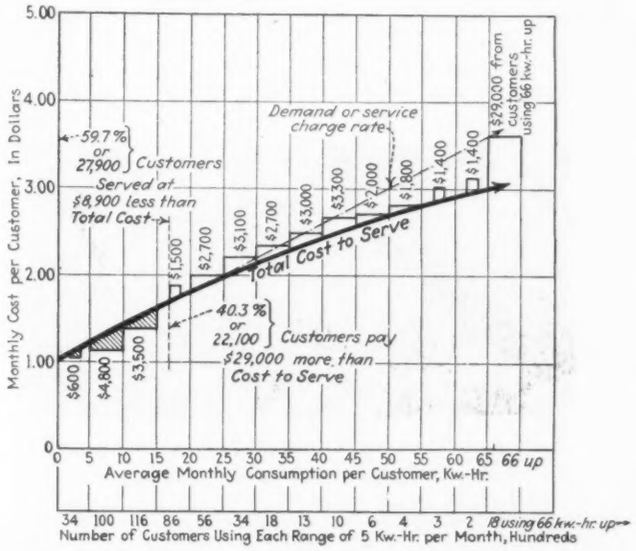

Monthly Cost per Customer, In Dollars
5.00
4.00
3.00
2.00
1.00
0
59.7% or 27,900 Customers Served at $8,900 less than Total Cost
Demand or service charge rate
Total Cost to Serve
40.3% or 22,100 Customers pay $29,000 more than Cost to Serve
$600
$4,800
$3,500
$1,500
$2,700
$3,100
$2,700
$3,000
$3,300
$2,000
$1,800
$1,400
$1,400
$29,000 from customers using 66 kw.-hr up
0 5 10 15 20 25 30 35 40 45 50 55 60 65 66 up
Average Monthly Consumption per Customer, Kw.-Hr.
34 100 116 86 56 34 18 13 10 6 4 3 2 18 using 66 kw.-hr up
Number of Customers Using Each Range of 5 Kw.-Hr. per Month, Hundreds

Fig. 3—Effect of a promotional form of rate

This chart shows in this situation the application of a service, area, room or demand promotional form of rate instead of the use of a straight-line rate. A room, area, demand or service charge may be used as desired and the rate earns 8.6 per cent on the total residence service investment. The rate shown represents an average service, room, area or demand charge of $1 per month per customer. The energy charge is taken at 4 cents per kilowatt-hour. Neither part of this rate is presented as a specific recommendation, it is a simple example showing the relation of kilowatt-hours to revenue per month under any promotional form of rate that may be designed properly to follow the progress of cost. This form of rate fully meets the problem in so far as the lighting and minor appliance usages are concerned, up to 50 to 75 kw.-hr. per month. The losses become negligible and the rate, lower per kilowatt-hour than the straight-line rate, follows the cost-to-serve curve much more closely. By so doing, the rate of return earned will increase to about 8 per cent. In or around the zone of 50 to 75 kw.-hr. per month a further form or step of a promotional rate must be introduced to encourage and meet the increased usage and demand costs of customers who wish to use refrigerators, ranges, washing machines, ironers and water heaters.

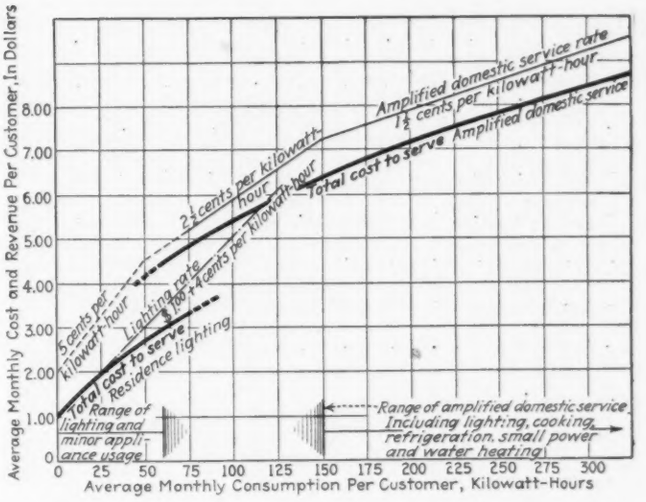

Average Monthly Cost and Revenue Per Customer, In Dollars
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0
Amplified domestic service rate 1½ cents per kilowatt-hour
2½ cents per kilowatt-hour
Total cost to serve Amplified domestic service
5 cents per kilowatt-hour
Lighting rate $1.00 + 4 cents per kilowatt-hour
Total cost to serve Residence lighting
Range of lighting and minor appliance usage
Range of amplified domestic service including lighting, cooking, refrigeration, small power and water heating
0 25 50 75 100 125 150 175 200 225 250 275 300
Average Monthly Consumption Per Customer, Kilowatt-Hours

Fig. 4—General form of promotional rate for all usages in domestic service

This chart shows the combination of the form of rate shown in Fig. 3, with the further promotional form of rate required for large usages. Up to 75 kw.-hr. the room, area or service charge form of rate is applied and closely follows the cost-to-serve curve, as established by known demand data. At 75 kw.-hr. this cost-to-serve curve is broken for purposes of demonstration only. This is done on the assumption, for this solution, that the customer at this point of his domestic electrification begins to install major appliances, as already enumerated. The company's investment dedicated to his use immediately increases with his demand and the cost to serve therefore increases, as shown at the break in this line, to the higher cost curve labeled "Total cost to serve amplified domestic service." This change, of course, does not occur as sharply as this break shows, for there is a zone around 50 to 75 kw.-hr. and up which is not exactly definable. The first or service form of lighting and minor appliance rate may work in some cases up to 100 kw.-hr.; the second or demand form may begin to work as low as 40 or not until 100 kw.-hr., as the circumstances of the customers' domestic affairs may determine. It will be seen that this arrangement of rates has the characteristics necessary to encourage full use of electricity for domestic service by decreasing unit prices through consistently following the progress of the cost to serve. As the average consumption per customer and the total kilowatt-hours sold for domestic service from year to year increase, the energy prices of these rates can be consistently lowered with the decreasing unit cost of service, without decreasing revenue or net income until a final low step in the rate is reached which will make complete electrification a household necessity.

major appliances. In this example, it is particularly desired to point out that it is a solution in which the use of only one meter is necessary to provide for the two rates combined in this demonstration. It is pointed out that these charts express a broad example of the rate technique that meets the fundamental problem. A successful application of these methods may produce several rates with progressively higher fixed charges and lowering energy prices as, for instance, in Hartford, Conn., or, on the contrary, only one demand rate may be developed with very satisfactory results, as at Buffalo, N. Y. No attempt is or should be made to recommend the gage by which the demand element may be introduced into the rate structure. The local characteristics and conditions of any given utility must determine the basis to be chosen, which will be most acceptable to the public and practically most applicable to the company's own methods and business.

Method of Analysis General

The method and presentation of this form of analysis as illustrated by these graphs is equally applicable to either electric or gas rate problems involving changes of rates as just described.

The American Gas Association in its excellent pamphlets on cost analysis and rate matters has strongly recommended changes from the old "flat" gas rate similar to those described here. In a recent gas rate case involving the inequity of a straight-line gas rate in the United States District Court in the Western District of

New York the decision has been summarized, in part, as follows:

> "A statute prohibiting a service charge or preventing a form of rate based on a service charge, a demand charge and a commodity charge, which would result in a proportional division of the costs among the customers, is arbitrary, confiscatory and in violation of the constitutional rights of customers and the gas company" and that "the right of a class of customers to be served with gas at a reasonable (allocated cost) rate which does not compel them to pay a large part of the cost of serving other customers, is a property right which may form the basis of suit by one or more customers of that class, and a failure to accord such right is confiscation of customers' property without due process of law. . . ."

It is very difficult to assume that this decision would not apply to electric rate cases with similar conditions.

The Possibilities of Promotional Rates

It may be asked what the promotional form of rate can do. In view of the development of the past five years and such exhibits as Figs. 1 and 2 of this article, it is not necessary to compare it with the results of the straight-line form. It is conceded, except by few, that under normal conditions the promotional form of rate is the most effective method by which to obtain the domestic service business the utilities have not yet secured. Wherever it has been skillfully applied, it has increased the consumption of the customers at a decreasing unit cost, but with an increasing revenue per customer.

In one study of eight large companies during the period of development of promotional rates it was found that the average consumption per customer increased in seven years from 318 kw.-hr. per year to 522 hours per year and the revenue per customer increased $6.15 in the seven years in spite of the decreasing unit price due to the promotional form of rate and several rate reductions during the period. As the number of residence customers in these eight companies amounted to nearly 2,000,000, the promotional rate showed very effective increased revenues at decreased prices.

How far the promotional process can be carried seems to be a process of evolution yet to be developed. Because it is progressive in its results with increasing consumption, no limits can really be set for the final low step of a well-designed promotional rate, as long as it follows the cost to serve. It is known, however, that as this step decreases, consumption increases sufficiently to maintain the revenue on a remunerative basis. Evidence is accumulating that the higher average consumptions produced by electric cooking, water heating, etc., reaching 2,000 kw.-hr. a year and over, will only be secured by a final low step in the rate of from 2.5 cents to 1 cent, depending on competitive fuel costs.

Such promotional rates have been in use for some time in a few sections in this country and the consumptions are reaching high figures. One case, in a great industrial city for 1927, gives an average domestic use of 743 kw.-hr. annually, with known increases for 1928. In California communities of comparatively small size, with slightly lower rates than in the city just cited, the domestic service consumption averages over 1,500 kw.-hr. a year. Analyses from high authorities in Canada show consumptions from a number of cities of over 2,000 kw.-hr. per year, with an average for 240 cities, towns and villages of 1,400 kw.-hr. per year per customer. In these latter communities electric ranges and water heating appliances are much used; the rates, of course, are very low, except in that part of the territory which has no material volume of industrial use of power, ranging broadly from 3½ cents per kilowatt-hour to as low as 1 cent per kilowatt-hour for the lowest step of the rate in the more favored localities.

The vast bulk of domestic business in this country, when fully developed, should make it possible to exceed these consumptions, and when this is done and our rates to other classes of commercial and industrial business have been readjusted in accord with the greatly increased grand divisor of kilowatt-hours from domestic business, the scope and future of the electric industry can hardly be visualized in the light of the present. This may be optimistic, but sound optimism has always paid in this industry.

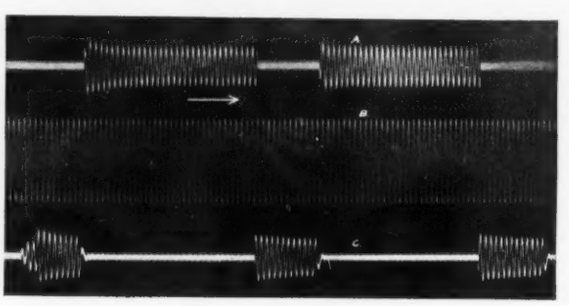
Speaking at large, the problem of making full domestic electric service popular seems to be one of teaching ourselves to price and sell our service better than in the past. The public must be educated as well as the industry to this great step in the progress of the communities served. The time has passed or is passing when it was feared that a fair hearing might not be obtained.

Many utilities in this country have consistently given to the public all the facts pertaining to this business, and as a result their customers have learned the basic underlying principles which must be respected, to the great benefit of both the company and the users.

Instantaneous-Reclose Breaker Clears Short Circuits

By H. M. Burriss* and E. S. Bailey†
Consolidated Gas, Electric Light & Power Company of Baltimore

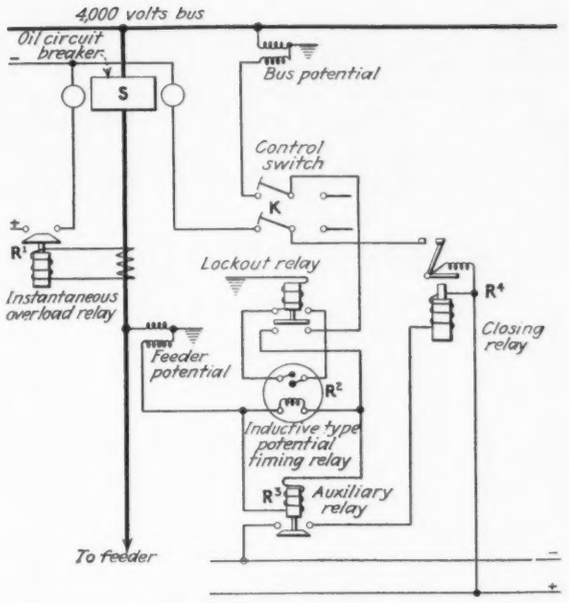
FOR many years there has been divergence of opinion among operating companies as to the best method of clearing troubles and the subsequent restoration of service on 4,000-volt distribution feeders. With most companies it has become a standard procedure to reclose the



Results with instantaneous reclosing circuit breaker

feeder breaker either automatically or manually only after a definite period of time following the instant it broke the circuit. Undoubtedly this predetermined time interval is intended to reduce oil circuit breaker duty and the corresponding maintenance costs of this unit, especially on circuits which supply only residential lighting. The requests of power customers may have the effect of delaying service restoration on a small percentage of this class of feeders. However, in general a certain time interval is allowed before the circuit which developed trouble is re-energized. In fact, manufacturers do not hesitate to recommend the restoration of service after such time interval.

**Assistant to superintendent (in charge of automatic equipment).*
†Assistant chief operator.



Relay arrangements for instantaneous reclosure

A method of reclosing such feeders instantaneously has been used successfully by the Consolidated Gas, Electric Light & Power Company for a number of years. Obviously the application of any method which tends to reduce outage time on these feeders is justified provided this advantage is not offset by increased installation or maintenance costs for the equipment used. Troubles common to feeders of this class are usually of such nature that they will clear after one or two operations of the connected relays. On sustained short circuit there is, of course, no particular advantage or disadvantage in the method herein described.

In 1913 this utility company used 4,000-volt feeders instantaneously reclosing feeders for the first time. The method then adopted was extended to all feeders in service and has been applied to new feeders since that time. With slight modifications this method is serving its purpose today very satisfactorily. The accompanying illustration shows the switchboard panel which accommodates the meters and relays of one of these feeders in operation.

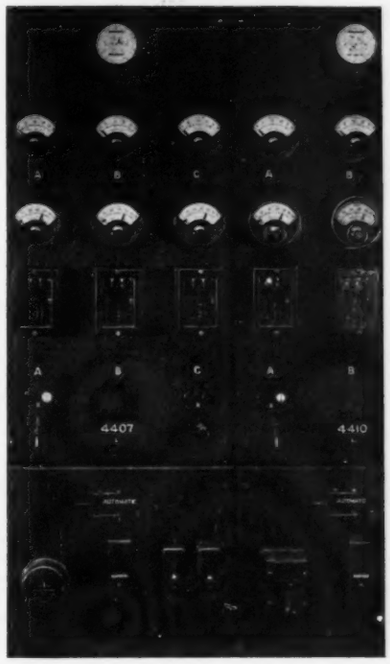
A brief description of the standard 4,000-volt, three-phase, four-wire feeder arrangement in our substations is as follows: Each circuit includes two 4,500-volt oil circuit breakers (one for each of two buses), one set of three induction regulators, two sets of disconnecting switches, instrument transformers, meters, relays, etc. The accompanying figure shows a simplified diagram of the primary circuit and includes the relay connections on which a complete cycle of operation may be followed. The relays are set to trip switch S three times and reclose it twice to complete the cycle. When the reclosing control switch at K is closed a normal operating condition is assumed, at which time, due to equal potentials, no current flows through the reclosing relays.

When a short circuit occurs on the feeder, R^1 trips switch S, which results in the loss of feeder potential. Bus potential then has a circuit to ground through R^2 and R^3. R^3 closes control on R^4, which in turn recloses switch S to re-energize the feeder. At this instant R^2 has completed only one-third of its travel and will depend on the feeder condition for final position. If the feeder is now clear of short circuit and re-energizes, R^2 and R^3 lose their currents and resume their former positions. However, if the trouble has not cleared the relay action will be repeated, after which R^2 will have completed two-thirds of its travel. Here again the final position of the relays depends on the trouble. If the trouble is sustained the relays will again repeat their operation. R^2 closes the potential on the lock-out relay, which closes on an interlock and makes R^2, R^3 and R^4 inoperative. As a result S remains open until the attendant operates the control switch K. The entire cycle of operation may be repeated at the will of the attendant.

Present number of 4,000-volt feeders in service, 119.

	1925	1926	1927	1928 to Dec. 1
Number of feeder troubles	467	515	350	597
Number of switch operations for clearing	817	858	562	936
Number of troubles cleared by opening and closing	349	397	279	472
Per cent interruptions avoided by reclosing	74.7	77.1	79.7	79.3

The oscillograph record of this operating cycle is shown for a test where a timing wave B of 62½ cycles was used. The current graphs are shown for the relays as follows: A for R^3 and C for R^1. It will be seen that the total time for tripping the switch three times and reclosing it twice on a sustained short circuit approximates 1½ seconds, which is an unusually short time.



Panel used for automatic instantaneous reclosing of feeders

From the standpoint of supplying public service, the advantage of this instantaneous reclosing feature becomes outstanding, as compared with any method which employs a time interval, when the results shown in the table, giving a high per cent of interruptions avoided, are considered.

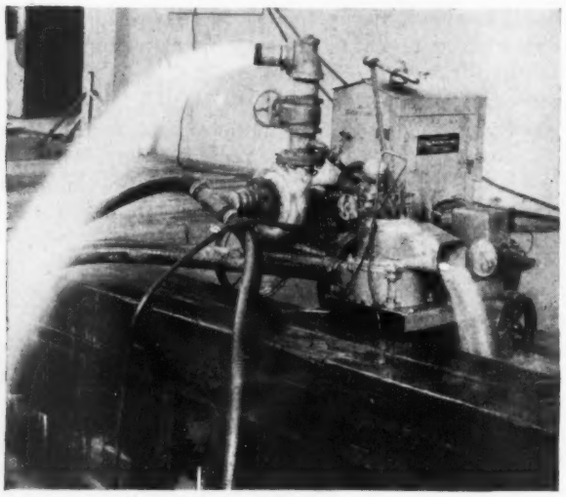
The maintenance costs on the 4,000-volt oil circuit breakers for the four years shown above are unusually low. There has never been a case of oil switch failure due to instantaneous reclosing. With the decided advantage of instantaneous restoration of service at no appreciable increase in maintenance costs, it must follow that preference would be given to the method hereby presented.

THERE can be no satisfactory excuse to offer for giving poor service as long as we stay in business, and that regardless of what rates we are allowed to charge.

—P. S. ARKWRIGHT,
President Georgia Power Company.

Centrifugal Versus Diaphragm Pumps for Unwatering Manholes

By H. T. Rogers
Assistant Superintendent of Underground Construction
New York & Queens Electric Light & Power Company



WHERE a large volume of water is to be pumped in a minimum time, the centrifugal pump is by far the best, according to the New York & Queens Electric Light & Power Company. The sump pit in the bottom of manholes insures sufficient water to hold the prime, so a well-trained operator can use a centrifugal in all ordinary cases.

A pipe tee is used on the suction end of the centrifugal pump to permit the use of two 3-in. hose in place of the large and cumbersome 4-in. hose ordinarily used. The use of smaller hose has speeded up the work of unwatering holes, decreased the breaking of foot valves and sump-pit gratings and reduced the hazard of damage to cables in the manholes.

Comparison of Diaphragm and Centrifugal Pumps
(Furnished by user)

Type	Gal. per Hour (Approximate)	Suction	Hp.	Net Weight, Lb.	Approximate Price
Single diaphragm	6,000	3 or 4	2	760	$230
Double diaphragm	12,000	4	4	1,600	430
Centrifugal	18,000	3	4	840	365
Centrifugal	30,000	4 or 5	15	1,350	675

Electric Brass Melting in Detroit

IN THE interview with Alex Dow entitled "Industrial Electric Heating," published in the Electrical World for December 15, 1928, there appeared a boxed statement of the industrial heating load in Detroit. In the tabulation of connected load of various classes of heating the item of brass melting is in error. Instead of a decrease in the two years, 1926 to 1928, from 10,045 kw. to 9,320 kw., there should have been shown an increase to 12,547 kw. This figure of 12,547 kw. represents only the furnaces for melting non-ferrous alloys that are connected to the Detroit Edison Company's lines. In addition, there are furnaces amounting to 5,175 kw. in capacity that operate on isolated plants.

The boxed statement to which this correction refers was not quoted from Mr. Dow, but was obtained from another source. The figures had to be estimated from data not designed for such a purpose.

Nearly 20 per cent of the electric brass melting in the whole country is done in Detroit, according to reports which say that the saturation of this field is higher than that of any other electric heating application in the territory.

Energy Required for Threshing

AS A result of an investigation by the Hydro-Electric Power Commission of Ontario performance data for electrically driven threshing machines of the type used in that province have been collected. Tests were made on 22x38-in. machines as manufactured by the Hergott Manufacturing Company and the John Goodison Manufacturing Company and on a 28x44-in. New Hamburg machine. It was concluded, in general, that:

1. The power required for actual work of threshing is small (about 4 to 5 hp.), the balance of that taken being used to supply losses such as friction in bearings, driving belts and windage.
2. Speeds recommended by the manufacturers are too high, resulting in excessive losses, plugging in the cylinder, frequent feed table stoppages and probably the carrying of some grain over with the straw.
3. The windstacker of many machines requires more power than the rest of the machine, due to the use of too large a discharge pipe, necessitating the handling of a large volume of air in order to have the necessary velocity to deliver the straw.
4. Belting losses are too high, caused by tight and crossed belts on drives with short centers.
5. Excessive bearing friction in some cases due to bending shafts in bearings where the drives are on short centers and belts tight.
6. New machines require about double the power until run-in.

It is suggested by the commission's engineers that "The use of roller chain and sprockets as a substitute for the present belts and pulleys on short drives should reduce the bearing and belt losses by 1 to 2 hp., and the use of a small pipe on the windstacker would allow a speed reduction from 600 r.p.m. to about 400 and save about 1 to 1½ hp. more, making the total power required between 10 and 11 hp. input, when threshing 70 bushels of oats per hour with average grain.

"The use of ball bearings would not materially reduce the power as long as the plain bearings are in line and well lubricated. Lack of lubrication on plain bearings will result in excessive losses. On our test a bearing ran dry and increased the load over 2½ hp. The use of ball bearings would tend to retain easy running over a period of years and reduce the attention necessary."

Power for Threshing Operations
Speed of cylinder—940 rev. per min. Speed of windstacker—625 rev. per min.

Part	Bearings Loss	Belts Loss	Windage	Total Losses	Work Done
Cylinder and main belt	0.3	1.0	0.5	1.8	2.2
Feed table, Band cutter, Feed rake	0.4	0.4	0.2	1.0	0.7
Drum cylinder	0.2	1.0	0.2	1.4	0.7
Decks	0.3	0.2	0	0.5	0.3
Grain cleaner fan	0.1	0.1	0.5	0.7	0
Grain auger, Grain elevator	0.2	0.1	0	0.3	0.3
Tailings elevator and auger	0.1	0.1	0	0.2	0.2
Total without windstacker	1.6	2.9	1.4	5.9	4.4
Windstacker	0.2	0.2	2.8	3.2	0
	1.8	3.1	4.2	9.1	4.4

Total power—9.1 (losses) + 4.4 (work) = 13.5 hp.
At—Increased speed (1,100 r.p.m.) for cylinder
(730 r.p.m.) for windstacker

Bearings Loss	Belts Loss	Windage	Total Losses	Work Done
2.0	3.6	6.8	12.4 hp	4.4

Total power —12.4 + 4.4 = 16.8 hp.

Foreign Progress in
Raising Load Factor

Utilities in European countries faced with necessity for intensive study of load possibilities, which has resulted in marked improvements in load factor, but has complicated rate structures and metering problems

By J. C. LANGDELL
Allied Power & Light Corporation, Jackson, Mich.

This information is based on observations of the author during a visit to France, Germany, Belgium, Switzerland, Holland and England. There he noticed rate schedules that require two-, three- and, in some cases, seven-rate meters.

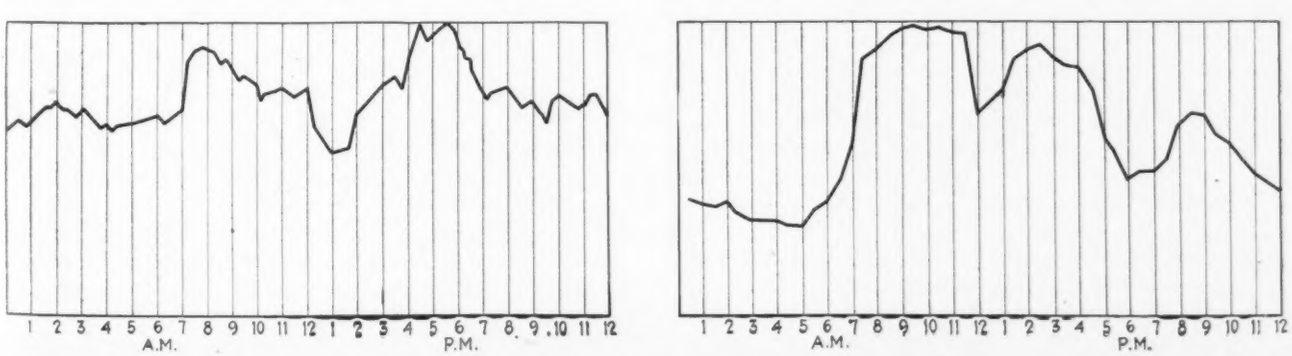
The diversity of rates is caused by the fact that the utilities are forced, in order to get business, to study costs very closely and to assign these exact costs to classes of load and to daily and seasonal periods in much greater detail than utilities in the United States are accustomed to do.

THE problems of metering energy to consumers are integral with the manner of electricity supply and with the rate structure under which charges are made. In comparison with many in use in Europe the rate structures common in the United States are simple. The European utilities have had to meet conditions much different from those in this country. Industrial demands for service have constituted the major factor in American utility growth. Heretofore residential and other small users, their requirements relatively small compared with industrial demand, have not had the attention and close study necessary fully to develop this class of load. The condition is very different in many parts of Europe. There the small consumer is of great importance. Persuading and enticing him to increased consumption of energy has become an art not yet fully appreciated in the United States.

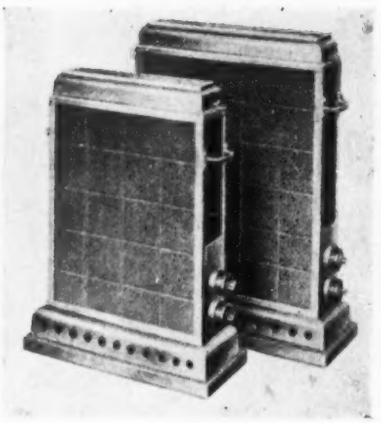
It is not necessary here to enter upon a discussion of the desirability of filling in system load curve valleys. The benefits to be taken from a flat load curve are apparent to all central-station men, particularly in the case of hydro systems on account of the large proportion of fixed charges. This is undoubtedly the reason why in Switzerland, where electric power is practically all water generated, there has been such outstanding progress made in the utilization of off-peak energy in common and household applications. Inspection of the accompanying load curves, in which is included one from a large Middle West utility in this country, will impress one with the progress made in the utilization of system capacity in Switzerland. This progress was not made overnight. It was a slow growth, as is shown by annual load factor statements in the city of Basel of 29 per cent in 1910, 44 in 1915 and 58 in 1921 and about 70 per cent at the present time. Load factor improvement is always a slow process unless there is a radical development.

The remarkable results shown in these curves have been obtained in great part by the use of electric storage heaters for heating homes, schools, offices and factories and of electric heaters for domestic hot water supply. In Basel the off-peak domestic load was raised 6,000 kw. by the installation of these devices. It is true that the sale of off-peak energy to many small users entails an added capacity of, and investment in, metering equipment. But the experience of many European utilities shows that the added maintenance and investment costs are small in comparison with the increased usefulness and earning power of the total system investment.

One of the most important outlets for energy in domestic uses in Europe is for water heating. Most, in



Daily load curves for 1927 in Basel, Switzerland, and for a Middle West utility system in the United States



Small type of accumulator stove

It gives off heat for two or three hours after current is cut off.

fact, practically all, of the heaters used are of the storage type so that advantage may be taken of off-peak rates. Domestic water heating is such a large contributor to load factor improvement on European systems and it is coming into such recognition in this country that it is worthy of more attention than can be given it in this article. The succeeding article of this series will be devoted wholly to this subject. In the meantime we will go on to the consideration of other off-peak energy uses.

The use of electricity for heating homes has been more generally adopted in Switzerland than in other European countries. This is on account of the large proportion of water-power generation. Swiss domestic heaters may be divided into two classes:

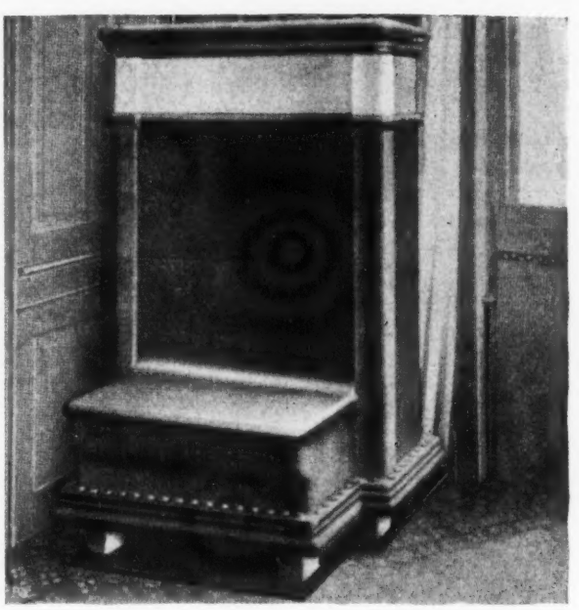
1. The so-called half-heat storage heaters with storage range limited to maintaining temperature for a certain period, generally three to five hours.

2. The full-heat storage heaters which are charged during the night hours and which have sufficient mass and a heat dissipation factor to maintain the temperature of a room constant during the eight hours.

The half-heat heaters are used as auxiliaries to the central heating system and are primarily day-load devices. They may be used, however, as direct heaters if desired, and can therefore be used for quick-heating purposes. Their real advantage, however, is as a part-time storage device in that they may be charged before the peak-load period and maintain the temperature of a room constant for several hours during and after the peak-load period. Such heaters may be put on a low-rate or two-rate schedule with some disconnecting arrangement during the heavy-load period.

The dimensions of the full-heat heaters depend upon the size of the room to be heated and the time available for charging. These heaters may be used as auxiliaries to the main heating system, especially during the spring and autumn, when such load devices are welcomed as a load by central stations, and also especially when the contract can be so made that the devices will not be used during the low-water periods, generally from the middle of December to the middle of February. The use of the device will also help out the central heating plant at a time when the steam heating demand is very variable, as, for example, during the early spring and late fall.

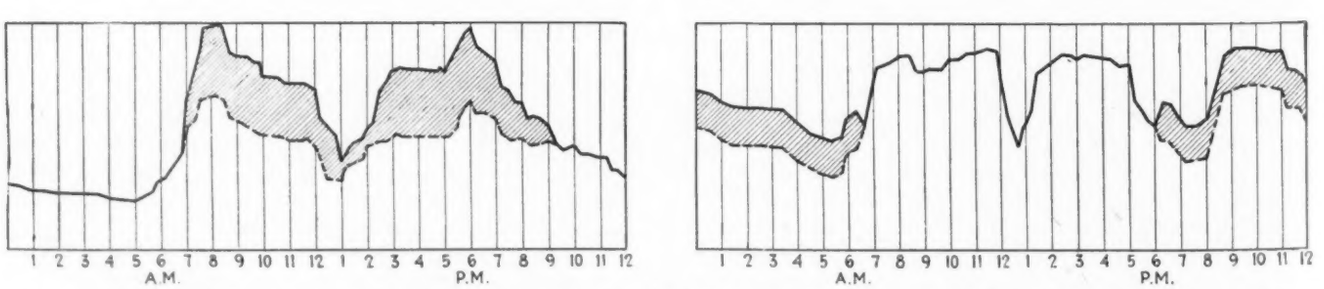
The heat thrown out by accumulating stoves during the night is just sufficient to hold the temperature. In the morning, after airing, the damper is opened and more or less closed again when the room temperature has risen to the desired value. These accumulating stoves are covered with plates or tiles. The interior is filled with sand and the heating elements are contained in iron tubes which are placed in this sand filling. A vertical chimney is in the center of the stove and the damper enables air circulation to be regulated. Small stoves are single phase up to one kilowatt; large ones are three phase. There is apparently no objection to using potentials up to 230 and even 380 volts. They must naturally be well insulated according to the pressure. Generally, the latter should not exceed 250 volts for portable stoves. Five hundred volts is often used on fixed stoves without any difficulty with heating elements. Accumulating stoves are only used for off-peak service, the rates varying from



Larger accumulator stove which is charged with heat at night and remains hot all next day

6 mills to 1 cent, depending upon the locality and country. At the end of 1923 there were more than 12,000 such stoves in Switzerland.

The general heating of buildings and homes with electricity has gone forward farther in Europe than in



Daily load curves of Zurich development in Switzerland for January and June days in 1926

The dotted line in the January graph represents use in the Zurich area and is properly the system load curve. The peak areas are power sold to other companies during the winter, when their water supplies are low. This power is generated with water pumped into the reservoir in the summer and is represented on the June graph by the areas above the Zurich area curve.

America. The methods include both utilization of off-peak energy with storage systems and any-time use with direct heating. In the latter class are many installations of heater coils imbedded in sand beneath soapstone floors. An off-peak installation at Baden contains 41,000 gal. of water which is heated by two-phase current at 220 volts with a demand of about 100 kw. The heat is regulated in the rooms of the building by valves that mix the hot water from storage with the colder return water. Another installation uses 250 kw. at 2,100 volts. A large hotel heating plant takes 750 kw. at 3,000 volts. The Commercial Bank of Italy at Rome is electrically heated.

In addition to the energy uses indicated for hot water and air heating there are large European uses of off-peak energy for industrial purposes, particularly commercial cooking. Special rate schedules encourage the commercial preparation of food products during the night hours. These off-peak uses make necessary a very considerable diversity of metering requirements, which will be treated in a forthcoming article.

Rejects Few in Electric Spring Tempering

By P. N. Rugg
Industrial Heating Division, Boston Edison Company

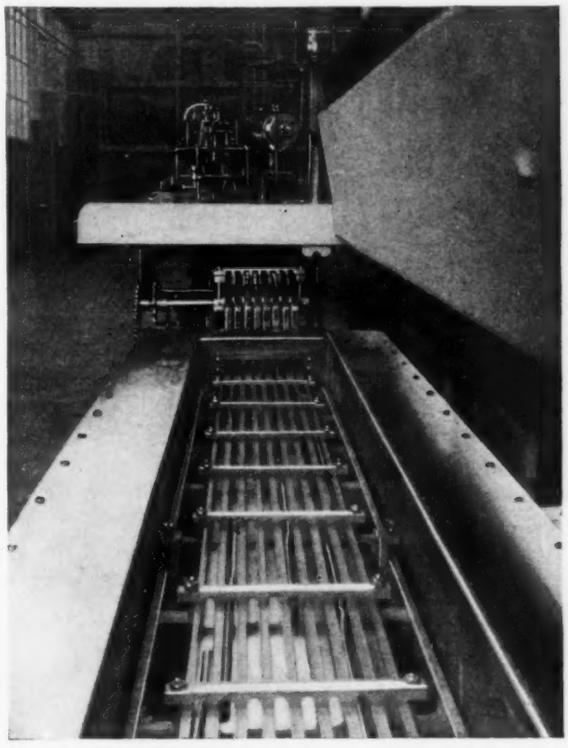
AN ELECTRIC conveyor type tempering oven rated at 10 kw. has recently been built by the Barber-Colman Company, Framingham, Mass., for use in the production of small steel springs of about 0.40 per cent carbon component formerly tempered by gas. This customer of the Boston Edison Company designed the electric oven for its own service because of the special requirements of the installation, and it is estimated that as soon as routine production gets under way a minimum of 100 lb. of steel will be tempered hourly with an energy consumption of 4.54 kw.-hr. The operating temperature is 650 deg. F. and the tempering process requires about two minutes per batch, the capacity of the electric oven being 200 lb. per hour. This is equivalent to an hourly production of 320 springs 1 ft. long, the wire being 0.012 in. in diameter and weighing $\frac{5}{8}$ lb. per foot.

The interior dimensions of the oven are 7 ft. $2\frac{1}{2}$ by 13 in. by 17 in. deep. The oven is provided with inner and outer shells of sheet iron with $4\frac{1}{2}$ in. of "Sil-O-Cel" insulation between the two, on all sides, top and bottom. One-quarter-inch sheet iron is used on the outer shell and the joints of the two shells are welded.

Four 2,500-watt General Electric air heating ribbon units are installed below the conveyor, operating on single-phase, 220-volt service. The operating temperature is maintained within plus or minus 5 deg. by a Bristol temperature control instrument and the oven is automatically preheated to working temperature by General Electric time switch control which turns the current on 1.5 hours before the factory opens. The time switch also automatically cuts off current at night. Only two settings of the time clock are required during a week's operation, one at Saturday noon for automatic preheating on Monday morning and a setting on Monday for automatic preheating during the week.

When the springs were tempered in the former gas oven considerable care was necessary to maintain anywhere near a satisfactory temperature in the chamber. As the load in the oven is dependent upon the number of winding machines in operation at one time, the varying amount of cold springs entering the oven required constant manual adjustment of the burners to obtain passable results. Automatic heat-controlling devices were tried, but with poor results.

The continuous conveyor arrangement used with the gas oven extended from under the line of winding



Interior of spring-tempering oven showing conveyor

machines into the oven and returning. This inefficient arrangement for charging the springs into the tempering oven required the heating of the cold tapes as well as the springs as they entered the oven. With the electric tempering oven, two conveyors are used, one located under the line of winding machines and the other totally inclosed in the tempering oven. The springs are discharged from the winding machines upon the traveling tapes below and are carried by these to the entrance of the tempering oven, where they are automatically transferred to the conveyor.

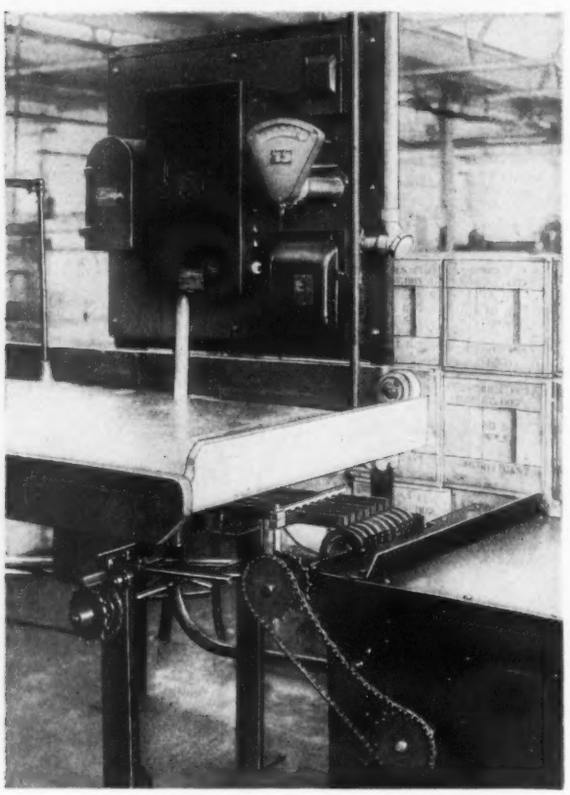
Eight lines of springs may be sent through the oven at one time, the conveyor speed being about 4 ft. per minute.

Springs wound from 0.007-in., 0.009-in. and 0.010-in. wire are also tempered in the oven. The springs are $\frac{1}{2}$ in. in diameter, with an allowable variation of 0.005 in., and are wound automatically, both right hand and left hand, from 8 in. to 36 in. in length. These springs are used on textile machinery and, consequently, must be properly tempered and of the same coloration over the entire surface.

Approximately 100 kw.-hr. are consumed per week for preheating the oven. The losses due to radiation from the oven walls and convection from the entrance and discharge openings are about 2.5 kw. when operated at 650 deg. F. At present only about 135 lb. of steel springs are tempered in the oven per day.

Rejects have been practically eliminated by electric

tempering, owing to uniform heat distribution, close temperature control obtained and absence of products of combustion, hot spots, scaling and oxidation. The elasticity of the spring coil and the color of the metal are uniform throughout the length of the spring. Conditions in the oven are the same for every charge of metal. No oven attendance is required and there is no danger of overshooting the temperature. Maintenance is at a minimum. There are no stacks or burners to be cleaned



Automatic control panel and conveyor drives

and repaired. No flames are present to warp or oxidize the cover, walls or conveyor mechanism. The nickel chromium heating units carry about 23 amp. and the low current density contributes to long life. Working conditions are also improved.

Electrical energy is supplied to the oven at 3 cents per kilowatt-hour. The cost of the oven complete was about $1,000, half being for the shell and insulation and half for equipment and labor.

The New Science of Seeing

By M. Luckiesh

Director Lighting Research Laboratory, National Lamp Works, Cleveland

THE lighting art is now passing through its primitive stage—the foot-candle era. In the work-world it is entering a much broader phase—lighting for seeing. It is also developing in many other directions so that it has already outgrown the narrow scope encompassed by so-called illuminating engineering. Future lighting art will be almost as extensive and complex as human activities.

Everywhere and in every way in which our eyes are used light is essential. These are doorways of light—the main passage between the complex exterior world and our complex consciousness. But this extensive panorama which spreads out before us is not one merely of light, of foot-candles, of physical and engineering problems. It is lighting in all its potentiality. It is a lighting art which will influence in countless ways the productiveness, welfare and happiness of human beings. To lay the foundation of its practice we must go far beyond the physics and engineering of light into psycho-physiological aspects of vision, and finally into the intricacies of feeling, affections, emotions, sentiments, volitions and associations. Some of the branches of this lighting art require specialists trained in science and arts beyond those encompassable in an engineering education. Engineering training and attitude have done very well in some places, but they have unconsciously applied brakes to progress.

The illuminating engineer has now before him an opportunity to develop into a *seeing* expert—to serve the work-world best in this new era of lighting which is at hand. Throughout the world of work where motion-study, safety devices, hygienic practices and many other modern ideas are being applied for making workers more productive with less fatigue and greater safety and comfort, perhaps there is not a *seeing* expert engaged in relating light, lighting and vision so that workers may see most quickly, most accurately, most safely, and most comfortably—so that human effort is converted into the greatest amount of useful work with the least amount of loss in useless work and fatigue. If there is one such seeing expert, he is still handicapped by lack of knowledge of the science of seeing.

Scientific researches are now working upon this foundation. Already there is much material which can be used by the lighting specialist who recognizes his responsibility and opportunity in applying this new knowledge for the benefit of a half-seeing world.

Maine's Rural Service Surpasses Ontario's

"IN PROPORTION to the population we have done more than any company I know of (in rural service) and have done it on a liberal basis. We have no government subsidy and pay over $1,000 per day in taxes, yet a larger percentage of our farmers is served than in the Province of Ontario, where the Hydro-Electric Commission's rural extensions are subsidized by the province and very little tax is paid on the electrical property. . . . It has been suggested that rural electrification would provide a market within the state. This is not so. A large percentage of the farms have already been provided with service. . . . It is estimated that if every farmhouse in Maine were furnished with electricity not more than 50,000,000 of additional kilowatt-hours would be required to furnish such service, and a great many such farms are so remote that the cost of reaching them exceeds the cost of small plants located on the farm. Central Maine Power is steadily increasing its rural service."

—Walter S. Wyman,
President Central Maine Power Company.

Wisconsin Wants Facts

Legislative interim committee investigates electric utility operation and organization in the state. Comparison of service conditions and rates in Ontario and Wisconsin. Municipal ownership advocates seek enabling legislation to permit competition with private utilities

An Interview with
J. P. PULLIAM
Vice-President Wisconsin Public Service Corporation, Milwaukee, Wis.

J. P. Pulliam

AN INTERIM committee of the Wisconsin Legislature has been busily engaged for the past few months in discovering the what, the why and the how of electric utilities in the state. To get a concise picture of this situation the ELECTRICAL WORLD interviewed J. P. Pulliam, who, in addition to his duties as vice-president of the Wisconsin Public Service Corporation, is chairman of the state's Public Utility Information Bureau.

Mr. Pulliam began by explaining that the Legislature of 1927 created a committee to conduct in the interim before the 1929 session an investigation looking toward the framing of the state's water power policy and with authority also to enter into all phases of the electric utility business as an inquiry into the effectiveness of regulation.

The committee opened wide the doors for any one to suggest an avenue of inquiry and would listen to any evidence submitted to it. The general attitude that the committee took was, "Well, here we are. Come out and tell us all about it." This was a disposition eminently fair, for while it permitted their opponents to advance their criticisms and their Utopian ideals, it gave the utilities opportunity to present the best of all evidence—the truth.

"So far the committee has held five public hearings," said Mr. Pulliam. "The first hearing, in February, 1928, concentrated on rates. The next, in March, was on rural service. Then the committee went to Canada to get first-hand data on the government-owned Ontario system. It took the testimony of many citizens and officials. Upon its return a hearing was held on the comparison of rates and service in Ontario and Wisconsin. The last two hearings, in November, dealt with state and municipal ownership. In each case the committee submitted a number of questions to all utilities and to any one interested. Answers to these questions were prepared and presented by representatives of the Wisconsin Utilities Association, by municipally owned systems and by the League of Wisconsin Municipalities.

Legislative committee hearings in Wisconsin during the past year afforded central-station companies in that state an opportunity to present evidence of their economic virtue. The hearings covered rate structures, rural service and a comparison of electric service and rates in Ontario and Wisconsin.

The utilities brought forward masses of evidence confuting the criticisms of private ownership that are the standard stock in trade of public ownership propagandists.

SPREAD IN RATES

"Questions propounded at the first hearing were replied to by utility executives prominent in the state. They stated that the general basis for electricity rates is the cost of service for each class of customers and communities plus a fair return. The difference or spread between domestic rates and commercial and industrial power rates was justified by the differences in cost in supplying these classes of service. Although all large companies are in favor of the adoption of a standard and uniform type of rate schedule for different classes of customers, it is doubtful if all communities would accept the same type due to possible increases for certain groups.

"The distance from source of power is not as important a factor as density of business in the determination of rates. For this reason territorial units for rate making cannot be arbitrarily fixed. In regard to the advisability of giving the Railroad Commission greater control over the expenditures of electric utilities and over extensions to plant and equipment, it was submitted that this would only increase the cost of operating this department of the state government. It would also carry the commission into the province of management and out of that of regulation. It would be inadvisable to write a prudent investment basis into Wisconsin law for the purpose of determining the value of electric utilities for rate making because the term 'prudent investment' is subject to wide differences in interpretations. It was shown that the difference be-

tween actual investment and reproduction costs at present is only about 12 per cent, and that this difference is continuously getting smaller.

"At the second hearing, which was on rural electric service, G. C. Neff acted as spokesman for the utilities. He discussed the present extent of rural service in Wisconsin, its technical aspects and the possibility of the increased use of electric current on the farm. He presented figures and charts to give the committee an idea of the cost of construction, maintenance and service. He informed the committee that the total number of farms receiving service from central-station lines increased in the state from 7,400 near the end of 1923 to 15,700 by the end of 1927, and stated that the average current used per month by farmers was 64½ kw.-hr. and the average monthly bill $4.64.

Comparison with Ontario

"The committee closed shop after this hearing and went up to Ontario for two weeks to study the operating conditions, rates and methods of financing employed by the Ontario Hydro-Electric Power Commission. When it returned a call was issued for a hearing to discuss and explain the reasons why the conditions of rates and service were different in Wisconsin from those in Ontario. The brunt of presenting the evidence at this hearing was carried by Mr. Neff again and by Ralph Moody of the Milwaukee Electric Railway & Light Company. Mr. Neff stated that unless the widely differing conditions between Ontario and Wisconsin were honestly and squarely equalized any comparison of rates would be unfair and conclusions would be without value. Such an equalized comparative study he submitted to the committee, stating that rates in the territory served by his company are lower than they would be in the comparable Ontario section were existing Wisconsin conditions transposed to Ontario. He proved in a detailed, step-by-step analysis that rates for domestic lighting in Ontario would have to be raised to an average of 9 cents per kilowatt-hour and retail power rates would have to be increased 125 per cent. On the other hand, if Wisconsin had Niagara Falls, and if Wisconsin properties paid no more taxes than do those in Ontario, service in Wisconsin would be at a lower cost than now prevails in Ontario. Mr. Neff stated that if Ontario rate schedules were adopted by his company it could give away its domestic load and still make as much money as it did in 1927 on the power load alone.

"In comparing rural electric rates, Mr. Moody stated that the average rural customer in the territory of the Milwaukee Electric Railway & Light Company would pay from 5.9 cents to 9.2 cents per kilowatt-hour if he were in Ontario, while in Wisconsin he actually pays 5.2 cents. One of the committee's questions indicated that Ontario was ahead of Wisconsin in the matter of bimonthly billing. This was refuted by Mr. Moody, who showed that the cost of billing for the entire Niagara system and for all municipalities served by the Hydro-Electric Commission is 72 per cent higher for the Milwaukee Electric Railway & Light Company and that the cost of collecting bills is 27 per cent higher.

"The hearing on the subject of public ownership occupied three days and because of the character of the questions propounded and the admirable manner in which replies to them were set up it would probably be interesting to discuss this hearing in a little more detail than the other. The questions themselves are illuminating and indicate the thought processes behind them." Mr. Pulliam then handed the following list of questions to the interviewer:

1. In what way can the Railroad Commission further assist municipalities that own and operate electric light and power plants or that are contemplating the purchase or construction of such plants? Should the same service be extended to private utilities?
2. What further legislation, if any, is desirable to enable cities and villages owning their own electric light and power plant to interconnect and co-operate with other cities and villages in the production and distribution of electric light and power?
3. Is it desirable that the public utility laws of the state shall be so amended as to empower the cities and villages to build and operate electric light and power plants in competition with existing power plants? Can this be done constitutionally?
4. Is it desirable that legislation be enacted to make possible the formation of power districts in which the municipalities and intervening rural districts may co-operate in the building, owning and operating of electric light and power systems? Can this be done constitutionally?
5. Does the policy of retiring the capital investment in electric plants through amortizing bonds result in a lower cost of service?
6. Is the incentive to economical management as great in a municipal utility as in a privately owned property?
7. Is labor employed more economically by municipal plants than by private utilities?

7a. Do municipalities charge municipal utilities with the full cost of service with particular reference to apportionment of wages of general employees who may be doing a portion of utility work?

8. Do changes in administration tend to increase labor turnover in municipal utilities?
9. Do municipal plants have the same high standards of construction and maintenance as those adopted by private plants?
10. Is the service rendered by a municipal utility as satisfactory as that of a privately owned property, with particular reference to liability for damages, prompt settlement of claims and bills and service on customers' premises in emergency?
11. Is there any actual saving to the community because the customers of a municipal utility are relieved from taxes which under the same conditions would be paid by the private utility?
12. Are rates of municipal utilities generally lower than those of private utilities, giving due consideration to differences in operating conditions, methods of electric generation, density of population, etc.

"W. J. Hagenah, vice-president of the Byllesby Engineering & Management Corporation, carried the case for private ownership in its general aspect. First, he denied the statement made by Mayor Daniel Hoan of Milwaukee that utilities are guaranteed an 8 per cent return on their reproduction cost. If such a guarantee were in force the state would owe the utilities millions of dollars. He submitted records showing that most companies in Wisconsin were earning less than a reasonable return and that one of the largest holding companies in the United States, after making a proper allowance for depreciation, earned last year less than 5 per cent on an investment in physical property exceeding $800,000,000. Mr. Hagenah disproved the overcapitalization claim by submitting that records of the regulatory commission revealed that companies had not issued securities in excess of their property investment. He quoted figures from the Byllesby report showing that the value of the physical property investment exceeded outstanding securities in 1927 by more than $50,000,000.

Municipal Versus Corporate Financing

"Mr. Hagenah submitted what I believe is the most comprehensive analysis of municipal and corporate financing that has ever been filed. This analysis demonstrates that the argument in favor of municipal financing is true only in the most superficial sense because it ignores the resulting shifting in taxes. He showed that what the public appeared to gain through issuance of government securities in place of corporate issues is promptly lost through the discontinuance of tax payments. He offered a study on more than two billions of securities sold by electric utilities which disclose that

the loss in taxes just about equals the saving in the cost of capital.

"Citing the experiences of eleven states which had engaged in private enterprises, Mr. Hagenah produced official records picturing the disasters that had followed state undertakings in banking, railroads, canals, flour mills, cement mills, warehouses, etc. More than $300,000,000 of indebtedness was incurred by these states in private business ventures in the hope of profit. So far $88,000,000 of indebtedness incurred for these purposes has been repudiated and several hundred million dollars of state bonds are still being carried by the public. He concluded his argument with a recitation of the success of public utilities in selling their securities to the public, creating public ownership in the true sense and making for a decentralization of wealth. This kind of public ownership, he said, embodies the advantage of private initiative, aggressiveness and inspiration.

Comparison in Wisconsin

"Following Mr. Hagenah, Mr. Neff made actual comparison of rates charged by municipal plants in Wisconsin with those of the Wisconsin Power & Light Company. His presentation proved that rates in municipal systems are higher on the average for each class of service than the rates of his company, taking population into consideration. In addition, he revealed that customers of his company used more electricity than customers of municipalities. He concluded with the remark that whatever success municipal distribution systems had in the state was due to the fact that private companies are producing energy for them and selling it to them below cost.

"Quoting United States Census Bureau figures, Mr. Moody then pointed out that in the group of states where municipal competition is keenest the average municipal rate is 4.38 cents per kilowatt-hour, while the average private rate is 2.81 cents. In states where competition is least municipal rates average 5.53 cents and private rates 2.06 cents. He assured the committee that such a condition is to be expected because duplication of property investments under competitive circumstances requires a relatively larger investment in both competing enterprises. Mr. Moody also showed that in the case of outstanding municipally owned projects in this country—Los Angeles, Seattle, Tacoma, Cleveland, Ontario Hydro—rates of privately owned utilities operating in the same territory are lower. This extra cost of providing service is inevitably reflected in the rates charged the public."

Mr. Pulliam then explained that the hearings may be continued if the committee decides that it needs more clarifying evidence on the questions raised. He concluded, "I believe that the subject will come before the Legislature in the form of bills sponsored either by the majority or minority of the committee. Some politicians have not yet grasped the significance of the will of the people as expressed so overwhelmingly in the last election. Therefore, they will continue to harass the utilities in Wisconsin and very likely in other states as well. If the utilities in other states can profit from our Wisconsin experience they will embrace every opportunity to get the facts before the public in such a clear and understandable manner that the average layman can comprehend them. In this connection, I may say that the papers, graphs and charts which we used as evidence for our case are being reproduced and will be available for use elsewhere if they are desired. We held nothing back and we believe the evidence submitted overwhelmingly and convincingly substantiates our case."

Improving Library Lighting

By Willard Allphin
Lighting Engineer Fall River (Mass.) Electric Light Company

MEASUREMENTS in the reference room of the Fall River Public Library formerly showed an intensity of illumination as low as 0.8 ft.-candle on the tables in the shadow cast by the reader. In the unshadowed areas 4 ft.-candles were observed, but conditions in the working plane were very unsatisfactory. The former lighting was by four semi-indirect bowls about 24 in. in diameter. These were somewhat expensive and harmonized with the room, so it was decided to retain them in modernizing the lighting. The dimensions of the room are 23 ft. x 70 ft., with a ceiling arching from 12 to 17 ft. above the floor.

In each fixture a silvered glass reflector capable of holding a 1,000-watt unit was suspended by small brass chains so that neither the reflector nor the chains were visible. The reflector is of the type having a small opal glass cup in the bottom, which serves to light the outer bowl. Lamps of 750-watt rating were installed in the reflectors and a highly satisfactory mainly indirect and shadowless illumination of 8 ft.-candles was obtained on the tables.

Letters from Our Readers

Unintentionally Annexed

To the Editor of the Electrical World:

In your issue of January 5, 1929, page 51, you have listed Canada under the title of United States possessions. Friendly as we are toward the U.S.A., we still prefer to work out our destiny within the Commonwealth of British Nations. However, we appreciate the delicate compliment you pay us by not listing us under "Foreign."

Toronto, Canada. A. L. Sutherland.

To the Editor of the Electrical World:

In the January 5 number of Electrical World, Vol. 93, page 51, I notice the United States possessions are listed as Alaska and Canada. Perhaps the wish is father to the thought, but I think it is farther from realization now than it was in 1812. J. A. Knight.

Arvida, P. Q.

[As much as we enjoy calling Canadians our brothers, we have no intention of trying to annex Canada by innuendo, as might be construed from the typographical error mentioned. We apologize and publicly recognize Canada as a commonwealth of the British Empire.—Editor.]

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Recent Hydro-Electric Developments.—C. R. MARTIN.—Differentiation between low-head plants, medium-head and high-head plants, stating that up to 40 ft. comprised low-head plants, from 40 to 800 ft. medium-head and from 800 to 2,300 ft. and above high-head plants. Comparison of three large hydro-electric installations made recently. Those installed for the Louisville Gas & Electric are low-head plants, operating at 100 r.p.m., using the propeller type turbine. The turbines installed at Conowingo operate under the head of 89 ft. and at a speed of 81.8 r.p.m. These turbines are of the single-runner, vertical type with Francis runner and hydraucone or concentric draft tube. For the Southern California Edison Company impulse wheel type turbines are used which operate under a head of 2,300 ft. maximum at 250 r.p.m. A tabulation is given comparing the three turbines in their various brake horsepowers, effective heads, revolutions per minute, etc.—*Purdue Engineer*, November, 1928.

A Revised Mollier Chart for Steam Extended to the Critical Point.—J. H. KEENAN.—In 1925 a steam table development was presented to the A.S.M.E. The demand for steam data has grown. The necessary data and many valuable suggestions were obtained by the General Electric Company.—*Mechanical Engineering*, February, 1929.

Generation, Control, Switching and Protection

Electrical Circuit Breaking.—E. B. WEDMORE, W. B. WHITNEY and C. E. R. BRUCE.—According to the authors electrical circuit-breaking problems can only be solved by separate study of the numerous variables involved. The investigators aimed at means for preventing the arc from restriking, rather than attacking the arc when heavy current is flowing, which may cause heavy energy release. An oil switch arc is often broken while the contacts are still within the gas bubble, so that arc extinction is not due to the quenching effect of the oil. Experiments in this investigation have proceeded along two lines, namely, study of the gas formed and of its arc-rupturing properties as compared with other gases with a view to its utilization to full advantage in arc rupture and best methods of utilizing the good features of oil for like purpose, the general aim being the utilization of each method separately or in combination in improved or new designs. Complete test apparatus was available and careful determinations were made. A novel camera capable of working at upward of 1,000 pictures per second was designed and the authors obtained information of great value. The phenomena of the alternating-current arc may be divided for convenience into the period of current flow and the period when no current flows, the gap between the contacts being filled with hot gas. In conclusion, it is remarked that oil introduces such factors as local gas production, surging, fortuitous contact of oil with the hot arc crater or the arc itself, which are difficult to control in ways which may assist and not hinder arc quenching. *Electrical Review (England)*, December 28, 1928.

High-Voltage Phenomena in Thunderstorms.—MARCEL A. LISSMAN.—Lightning phenomena are analyzed in the light of laboratory experience with high-voltage phenomena in the atmosphere. Special emphasis is placed on the effect of space charges in producing high local stresses when mobilized through channels of high conductivity caused by high temperatures. A detailed analysis is included of the steps through which air at atmospheric pressure passes when used to apply electric stresses if electric properties change from those of a non-conductor to those of a highly conducting body, and then again resumes its original non-conducting property.—*Journal American Institute of Electrical Engineers*, January, 1929.

A New Era in Switchgear.—H. TRENCHAM.—In an endeavor to produce a simplified unit design of apparatus which would reduce costs and assist in the progress of standardization and in order by means of such reduced costs to render available metal-clad unit switchgear for every grade of power distribution and supply business, a British concern has recently introduced a new design of metal-clad equipment. The equipment described in this discussion not only offers considerable space saving over either the truck or compound-filled type but a number of other features have been included. The standard fixed chamber is arranged to house the busbars and the circuit egress fittings. It is provided with six bell-shaped socket insulators carrying isolating switches. Each unit is self-contained and there are no oil-tight or compound-tight joints to make between equipments. The busbars are insulated and pass from chamber to chamber by looping up over the intervening barriers. The circuit plugging chamber is used also as a cable-sealing chamber and the design has been greatly simplified. The apparatus is said to be solidly designed and its simple form enables outdoor installations with but little addition to standard equipment. Such addition comprises, in the main, sheet steel panels to fill in the pedestals in back and a door in front to shut off the operating parts from interference.—*Electrical Review (England)*, December 14, 1928.

Transmission, Substations and Distribution

The Automatic Substation and its Relation to the Electric Distribution System.—S. J. LISBERGER.—The author has endeavored to point out some of the advantages gained by the use of automatic substations and to discuss in a general way some of the factors that play a most important part in the distribution of electrical energy to a community. The conditions under which the automatic substation is best adapted to use and the factors of design in which the automatic station differs from the attended station have been pointed out. The most important elements in the latter classification include: Design of the building if apparatus must be housed or design of the structures if it is to be outdoors; ventilation, in the case of housed equipment; fire risk; economical arrangement of apparatus, particularly with relation to the building structure and with the interconnected devices, and arrangement and grouping of the apparatus to facilitate quick inspection and location of faults. In conclusion it is emphasized that inspection and maintenance are exceedingly important in the successful application of this modern idea in distribution practices.—*Journal of the American Institute of Electrical Engineers*, December, 1928.

Copper-Cadmium Conductors.—An evaluation of the worth of the new alloy wire consisting of copper and cadmium. Experience and test results indicate that this conductor material possesses the pliability of annealed electro-copper, the conductivity of hard-drawn copper and a high breaking strain and resistance to wear. It is stated that while it may be somewhat premature to make a forecast it appears probable that this type of wire will eclipse all other special brasses and bronzes which in the past have been employed for purposes where durability, tensile strength, hardness, high annealing temperature and electrical conductivity are necessary qualities. Data regarding service characteristics and the composition of materials have been included in this discussion.—*Electrical Review (England)*, December 7, 1928.

A Large Interconnection Scheme.—THEODORE RICH.—A voluntary co-operative system is used in the south of France for the interconnection of certain power stations in that district. The author has given a description of the stations involved in the interconnection and of the working agreement under which the interchange of power takes place. Under this arrangement a central organization fixes a price each year at which certain electrochemical subscribers to the system agree to take the excess power and the price is a function

of the market price per equivalent to kilogram of nitrogen. When the demand for power exceeds the contracted supply, the surpluses not contracted for are divided up among electrochemical or other consumers according to certain rules fixed by the board. Main line voltages of as high as 150,000 are used on this project.—*Electrical Review (England)*, December 28, 1928.

Units, Measurements and Instruments

New Type Potential Transformer.—A. IMHOF.—If a high, non-inductive resistance is connected between line and ground, a current flows through it, which is proportional to the line potential to ground. The primary of a current transformer may therefore be connected between the end of the resistance and ground, while an ammeter, calibrated in volts, can be connected to the secondary. Very fine, enameled resistance wire is wound non-inductively onto small coils, each coil for about 10 to 20 kv., and a stack is formed of the coils, with a central insulating tube. At the base of the tube are mounted one or two small transformers, with a secondary for ½ amp. and a burden of 15 to 20 volt-amperes. The whole stack is mounted within a larger outside cylinder of insulating material, with oil as a filler. If intended for outdoor installation, a tall porcelain tube with a number of petticoats incloses the structure. Compared with the customary type of potential transformer, great savings in size, weight and cost are, it is claimed, realized with this new type.—*Bulletin de l'Association Suisse des Electriciens*, December 7, 1928.

Simplified High-Voltage Potential Transformer.—G. KEINATH.—For voltages of 100 kv. and above the cost, weight and size of potential transformers rise rapidly. Costs are about proportional to the square of the potential. On instrument transformers the insulation is the main problem, while the transforming part is of very secondary importance. Surprising economies in every respect can be obtained by reducing the line potential gradually in a chain of several small transformers in series. Each unit has a main, coupling and flux-confining winding, while the last unit in the chain has an additional secondary for the instrument. Each unit is built with a shell type core and is placed in a porcelain shell, the air space completely filled out with a semi-solid insulating compound. The individual shells are placed on top of each other, forming thus a tall cylinder. Three to six units are needed for 110 to 220 kv. The output of these new transformers is between 40 and 1,000 volt-amperes. The accuracy is within less than 1 per cent, the test voltage is 2.2E + 20 kv., and impulse strength as high as 700 kv. for the 220-kv. chain. A specially built series chain type protective resistance is recommended as an additional impulse protection. The cost of these instrument transformers is only about one-half to one-third of the cost of the customary type.—*Siemens Zeitschrift*, November, 1928.

Application of Wound Type Current Transformers Installed in High-Voltage Oil Circuit Breaker Tanks.—J. C. REA.—Wound type current transformers installed in the tanks of high-voltage oil circuit breakers have been in operation for many years. The experience gained during this period has, according to the author, resulted in fairly clear definitions as to the types of installations to which they are best suited and to designs of transformers which are highly reliable. This discussion is an endeavor to present a brief history of some of the developments which led up to the present application of wound type current transformers in circuit breakers and to indicate some of the conditions under which they offer special advantages.—*Journal of the American Institute of Electrical Engineers*, December, 1928.

Illumination

The Effect of Dark Surroundings Upon Vision.—P. W. COBB and F. K. Moss.—The purpose of this discussion is to estimate the extent of bright surroundings necessary to abolish the known adverse effect of dark surroundings upon vision on a small, bright, working field. The test of vision used was the accuracy with which the subject could keep a manually operated stylus in opposition with another, slowly and irregularly moving, mechanically operated stylus. Both of these were seen in silhouette upon a small bright field. The results here stated are derived from a total of 390,000 measurements. The precision with which the subjects could follow the moving stylus in general was highest with the largest extent of bright surroundings, lowest with the smallest. Although represented by some 65,000 measurements for each of the six sizes of surrounding field used, the results were still somewhat irregular. The extreme difference in precision was from 4.3 to 7.7 per cent. A large part of this difference, 2.8 to 5.6 per cent, occurred when the border of the bright surroundings was pushed outward from 8 deg. to as far as 16 deg. from the visual line. The plotted results indicate that there is no advantage to be gained by extending the bright surroundings beyond this.—*Journal of the Franklin Institute*, December, 1928.

Code of Lighting: Factories, Mills and all Other Work Places.—This code, it is stated, is intended for the use of all who are interested in enactments, rules and regulations for better lighting as well as a guide for factory owners and operators in their efforts to improve lighting conditions in their own plants. The first part of the code contains rules arranged in convenient form for legal enactment or governmental regulations; the second contains a discussion of the rules of the first part; that is, the legal requirements which must be met where a code is in force and also suggestions and general information as to desirable practice in factory lighting, and the third part takes up the advantages of proper and adequate illumination both natural and artificial and discusses such lighting particularly from the standpoint of economics. The present standards of foot-candles of illumination for industrial interiors have been tabulated according to industry and including the various sub-classifications. Illustrative examples showing the results obtainable with various standards of illumination have been included and tabulated information regarding other lighting factors appended.—*Transactions of the Illuminating Engineering Society*, December, 1928.

Traction

Austrian "B + B" Locomotive.—L. MANDICH.—For the operation in steep Alpine sections of the Austrian Federal Railways, a light locomotive was required for freight and passenger train service, suitable for rounding frequent and short radius curves. A maximum weight of 60 tons was not to be exceeded, curves of 300 ft. had to be managed and grades of up to 3.65 per cent are encountered. An engine was designed for these severe conditions, running on two four-wheel articulated trucks (B + B type), with each axle motor driven over 1:5.87 spring spur gear reduction. Each of the 16⅔-cycle, single-phase motors has a continuous rating of 275 hp. and a fifteen-minute rating of 500 hp. A forced air-cooled, oil-immersed transformer of 1,100 kva. output steps the 15-kv. overhead potential down to 360 volts with eight starting taps below. For normal train service automatic control is provided; that is, the motorman turns the controller handle, when starting, to the end notch, which starts a spring motor, governed by current relays, to move the actual controller notch by notch, without further attention. For yard service the handle is directly connected to the controller, by-passing the spring motor. The highest speed of the engine is limited to 38 m.p.h.—*Elektrotechnik und Maschinenbau*, December 9, 1928.

Miscellaneous

Economics of Electric Cooking Loads. GEORGE H. LOFTS.—An article descriptive of the use of electric ranges in Australia in connection with other types of loads, description of range test, and of operating results indicating that the maximum demands for ranges usually occur during the noon valley in the load curve, precede the load curve increase in the morning and follow its decrease in the evening, giving therefore generally good load factors. A method of determining the diversity factor of electric range loading is given. Mention is also made of storage type waterheating.—*Electrical Times (Australia)*, November 27, 1928.

News of the Industry

A.I.E.E. Convention Intensely Practical

Circuit-Breaker Development, Protection Against Lightning and Cable Research Command Major Interest in a Well-Balanced Program—Edison Medal Presented

THREE groups of papers presented at the winter convention of the American Institute of Electrical Engineers in New York this week attracted unusual attention from operating engineers, manufacturers and research men, filling the Engineering Societies' large auditorium to capacity at each session. These papers, all intensely practical, dealt respectively with the theory of a new development in circuit breakers and field experience in their use; with lightning-protection investigation and experience, and with cable research and development. Features of papers on the first two groups of subjects are presented on pages 233 to 241 of this issue. The papers on cable research will be abstracter quite fully next week, when a complete summary of all discussions will also be printed. The remaining sessions of the five-day convention were devoted to dielectrics and electrophysics, communication, induction motors, electrical machinery and electrical instruments and measurements.

At an evening session the Edison medal was presented to Dr. Frank B. Jewett of the American Telephone & Telegraph Company for his outstanding accomplishments in the field of electrical communication. This ceremony was followed by a lecture on "Electricity and Chemistry—Team Mates in Progress," by Harrison E. Howe. The customary smoker, dinner-dance and inspection trips were well attended.

In general, the discussion of the new "Deion" circuit breaker embraced enthusiastic commendation of operating engineers of the Westinghouse Electric & Manufacturing Company for the development of this apparatus, together with consideration of its limitations and suggestions for further investigation.

The comments on lightning protection emphasized the importance of coordinated field and laboratory investigation, involving the value of ground wires, surge attenuation, the value of cathode-ray oscillographs and klydonographs and the steepness of transient wave fronts. Divergence of scientific opinion on some subjects was regretted.

Cable discussion shed some new light on pressures developed within cables, migration of compound, causes and measures of voids, value of shielding, effectiveness of oil reservoirs, relation of cable characteristics and value of bonding.

Dr. O. J. Ferguson, dean of engineering at the University of Nebraska and senior vice-president of the Institute, presided at the opening of the convention in the absence of President R. F. Schuchardt, who was ill. A total registration of 1,275 from all parts of the country was recorded up to Thursday noon.

Edison Medal Presentation

Vice-President H. A. Kidder presided at the Wednesday evening session, and Dr. Ferguson made the formal presentation of the Edison medal to Dr. Frank B. Jewett, following an address by General John J. Carty, vice-president of the American Telephone & Telegraph Company, with whom Dr. Jewett has been closely associated in his work. Dr. Carty dwelt on the achievements of the recipient of the honor in developing telephonic communication during the last quarter of a century, alluding particularly to his part in bringing about the epoch-making transcontinental and transatlantic developments. In accepting the medal Dr. Jewett pointed to the benefits of co-operation and research in the arts of communication. "In no other field of modern industry," he said, "has the fruitage of pure science through co-operative effort been greater. Nowhere else is the power of the industrial research organization more potent, more firmly incorporated into the business structure or has it provided a more reliable and powerful weapon for attack upon problems unsolved."

Another High-Pressure Boiler for Lakeside Station

Approximately $1,500,000 will be expended by the Milwaukee Electric Railway & Light Company this year in expansion of the boiler capacity and auxiliary equipment at its Lakeside power plant. A boiler operating at a pressure of 1,390 lb. per square inch and costing $725,000 is the chief item in the program. This boiler will be similar to the high-pressure boiler installed at Lakeside two years ago. It will generate 300,000 lb. of steam per hour at a temperature of 750 deg. Expanding first in special high-pressure turbines and then in machines of normal pressure, the steam from the new boiler will develop energy equivalent to 40,000 hp. This boiler will serve to match the steam capacity with that of the electrical generating equipment, which was increased to about 235,000 kw. last year by the addition of two turbo-generators, one of 60,000 kw. and one of 7,700 kw. rating.

A building addition to house the new boiler, an addition to the switchboard building, expansion of coal-handling equipment and miscellaneous smaller improvements make up the rest of the budget. The boiler-room extension will be 92 ft. square and 108 ft. high. Another smokestack, 198 ft. high, 23 ft. in diameter at the bottom and 19 ft. across at the top, will be built, and provision will be made under the building for future additional water-condensing tunnels. The switch-house extension will be 66 ft. long.

Nebraska Occupies Stage in Utility Investigation

Former Director of N.E.L.A. Middle West Division Testifies Concerning Appointment of His Successor and on Information Bureau Activities

MORE indiscreet letter writing was aired at the hearing in the Federal Trade Commission's investigation of public utilities held on January 25, when Horace M. Davis of Lincoln, Neb., former director of the Middle West Geographic Division, N.E.L.A., took the stand. On the same date Stephen B. Davis, director of the Joint Committee of National Utility Associations, testified that publicity activities have been virtually discontinued by that body. That the committee was previously spending large sums on publicity for general and specific purposes was brought out early in the investigation. This work has been curtailed during the past year, Judge Davis stated, until at present it is confined to a weekly news bulletin and the running story of each day's Federal Trade Commission hearing.

H. M. Davis testified that he served as director of the Middle West Division for seven years. He was replaced in 1927 by Thorne Browne, who had failed to be re-elected as State Railway Commissioner. A letter from Mr. Davis to John N. Cadby, secretary of the Wisconsin Utilities Association, produced by Judge Healy, the commission's counsel, Mr. Davis explained as having been written to a friend while the writer was influenced by pique at losing his situation. In this letter Mr. Davis said, referring to Mr. Browne: "Our people were particularly interested in him and lost immeasurably in his defeat. They figured they owed him something—true enough. He is a judge, a philosopher, methodical, studious, impelling in personality, opinionated and naturally executive."

Mr. Davis told the commission that

the utilities were pleased with Mr. Browne's course as a commissioner and that they wanted to engage him on the principle that a man of his ability was hard to find. He was induced to accept the Lincoln office rather than a pending place in Washington. When asked whether utility companies had contributed to Mr. Browne's campaign expenses, Mr. Davis said he had been so informed and, under pressure, reluctantly gave, as his informant, the name of a Nebraska man in no way connected with the utility industry.

Further testimony showed that the Nebraska utilities' information bureau cost the utilities $8,000 to $12,000 per year. Its operations were much the same as those found in investigating the other regional offices under the same central supervision. Since his directorship ended Mr. Davis has received $150 per month for preparing news material for the bureau.

Browne Denies that Utilities Aided Him in Politics

The ELECTRICAL WORLD learns from Lincoln, Neb., that Thorne A. Browne, director for the Middle West Division of the N.E.L.A., enters a vigorous denial of the statements made in the testimony before the Federal Trade Commission of Horace M. Davis, whom he succeeded in office, that the power companies contributed to his unsuccessful campaign for renomination as a member of the State Railway Commission in 1926. Mr. Browne says that he paid his own expenses and that not to his knowledge did any outside parties contribute. Frank E. Helvey, secretary of the Insurance Federation of Nebraska, named by Mr. Davis as his informant, says that he never heard that such a contribution had been made and had never told Mr. Davis so.

In the States' Legislative Mills

New Commission Proposed for Arkansas—Attacks on Indiana Law —Water-Power Surveys Asked in Nebraska and North Carolina—Wyoming and the Colorado River Pact

INDIANA is again to the fore with a large crop of bills aimed at utility companies or prescribing changes in their method of regulation, but there is plenty of activity also in other states, as the following reports bear witness:

ARKANSAS.—Plans to fight against the passage of a bill held to be aimed at municipal utilities are reported from a conference in Little Rock of representatives of cities operating such plants. The contemplated measure would, it is understood, place municipally owned plants under the control of a state utilities commission, which would have power to prohibit establishment of a municipal plant in a city already served by a private company.

CALIFORNIA.—A bill has been introduced in the Upper House of the California Legislature which would prohibit corporations protected by the state in competition and in rates from using any portion of the money derived from the rates charged in financing political movements concerning which there is a division of opinion on the part of the public paying the rates. Lobbying, advocating legislation, making political campaigns or spending money for any political purpose would be prohibited.

ILLINOIS.—Representatives of the Illinois Municipal League have outlined a program of legislative action designed to clarify the present law regarding the right of municipalities to purchase power, to restore complete "home rule" to them where utilities are concerned, and to give them authority to double the bond issue limits upon assessed valuation for public works from 2½ to 5 per cent. This fight for "home rule" legislation is one of long standing and is directed against the Illinois Commerce Commission's authority to pass on franchises and rates in any city. The league faces the prospect of a backfire in the shape of bills transferring municipal light plants to the jurisdiction of the commission.

INDIANA.—Repeal of the Snively-Spencer Public Service Commission act, with consequent displacement of present members of the commission, is the object of one of two utility bills introduced in the Indiana House of Representatives by Representatives Kistler and Knepper. The companion bill would rewrite and re-establish the entire utility act and would make changes in the methods of determining utility valuations for rate-making purposes, issuance of bonds and purchase and sale. "Actual cost," as reflected by the books of the utility corporation, would be the measure by which valuations would be fixed by the commission instead of "true value," the wording of the existing statutes. This bill also would prevent all public utility companies from manufacturing or selling apparatus or devices "designed to consume the product of such utility."

The Indiana Public Service Commission law will become the target of still more legislative attacks in the General Assembly soon, when Robert L. Moorhead of Indianapolis introduces measures now being prepared. He has stated that he does not intend to reintroduce his bill of two years ago which attempted to restate many of the fundamental principles of the law. One of the bills being prepared will renew the fight to bring public utility holding companies under the jurisdiction of the commission.

Another bill seeks to give the Public Service Commission use of all the fees it collects—$100,000 or more annually—for hiring expert accountants and engineers when big mergers are proposed.

The commission will be authorized to increase from 60 days to 120 days the period of suspension of new rates if a bill just introduced becomes a law.

In view of the activity of the Indiana General Assembly in seeking what the members term "remedial" legislation for utilities, the utilities are beginning to awaken to the fact that some of the present laws are in danger either of direct repeal or of being so curtailed in action as to be practically valueless. Last week a group, headed by W. A. McInerny of South Bend, representing the Insull interests, appeared before the cities and towns committee of the House with a request for a continuance of a hearing on the McKeeson bill to remove municipal utilities from the jurisdiction of the Public Service Commission.

MINNESOTA.—A bill which would authorize any city of the third class to contract to supply electricity to residents within one mile from the city limits was introduced and referred to the municipal affairs committee.

NEBRASKA.—Backers of the partly abandoned combination irrigation and power Tri-County project (frequently referred to in the ELECTRICAL WORLD) are asking the Legislature to expend $25,000 in making a survey of the state water resources, both surface and underground, as a preliminary to adopting two years hence a comprehensive plan for their conservation and utilization under strict control of the state. The board is to be made up of the Lieutenant-Governor, Attorney-General, Speaker of the House, State Engineer, dean of the College of Agriculture and other officials, with such representative citizens as the Governor may desire to name, and is to work in conjunction with the federal government. Feasibility and possible locations of hydro-electric and steam-electric plants are to be considered.

An appropriation of $525,000 is carried in a bill introduced to finance the construction, maintenance and operation of a combination heating and power plant for the new State Capitol, the executive mansion and for the University of Nebraska downtown campus buildings.

NEW YORK.—Appointment of a Moreland act commissioner to investigate the Public Service Commission with a view to more effective regulation of public utility corporations and to obtain the benefit of cheap light and power for the citizens of the state is urged by the City Club of New York in a long and carefully argued letter to Governor Roosevelt. A similar request to the Governor has been made by the Public Committee on Power, headed by Arthur Garfield Hayes. This committee also suggested that there be created the office of people's counsel to represent the public in utility rate and regulation cases, and that Governor Roosevelt "rehabilitate the Public Service Commission by the non-political appointment of men who have demonstrated their willingness to advocate the consumers' point

of view and who are qualified by experience as experts in matters of regulation or administration."

Pressure, it is said, is being brought to bear on the Republican leaders of the Legislature by manufacturers in the central part of the state, especially in the Mohawk Valley, not to stand in the way of the development of water power from the St. Lawrence River by adhering too tenaciously to the position they maintained throughout the last three administrations of Governor Smith.

Among bills introduced is one setting up a temporary commission to represent the state at hearings before Congress and committees, the Parliament of Canada, the International Joint Commission and other bodies concerned in the proposed St. Lawrence waterway and power plants.

NORTH CAROLINA.—Representative Kluttz of Catawba is the author of a resolution to appoint a committee to investigate the water-power situation in the state, because of a "widespread sentiment" that the benefits of water-power go "almost exclusively to private interests." The committee would be made up of three members of the House and two members of the Senate and would have power to summon witnesses and compel the power companies to produce their books for examination.

NORTH DAKOTA.—Representatives of fifteen cities and villages at a meeting in Mandan have formed a league of municipalities of the west Missouri slope with the intention of launching an attack, through the Legislature, on electric rates. The group charges that the public utilities "are charging electric rates based wholly on what they can make the consumer pay." The proposed legislation will include a provision which would permit municipalities to purchase electric light plants within city limits at the "actual physical valuation, without the watered fictitious value of the franchise under which the utility operates." It is asserted that the league is determined "to force the utilities down to 3 cents per kilowatt-hour for all kinds of electric service."

OHIO.—Governor Cooper's plan for repeal of the Pence utilities law and establishment of machinery to speed up the determination of rate cases is now before the Legislature and will probably be pushed to speedy enactment. Under it, facts regarding valuations of utility properties will be obtained by attorney-examiners and laid before the commission for final judgment. The Pence law, as it now stands, gives utility companies the right to increase rates before they are passed upon by the utility commission. The Governor has appointed Frank W. Geiger of Springfield to the Public Utilities Commission, completing its membership and providing a Republican majority of two members to one.

OREGON.—The Attorney-General of Oregon has been asked to prepare a ballot title for an initiative measure to abolish the Public Service Commission by the repeal of all sections of the code now affecting the regulatory department.

Upon recommendation of the Oregon State Tax Relief Committee, the Legislature is considering a bill to authorize the Public Service Commission to require all municipally owned utilities to file annual reports in accordance with the commission uniform accounting system.

A bill has been introduced to repeal the law which provides for the application of certificates of convenience and necessity before public utilities may operate in the state. The enactment of the measure would remove all barriers to the establishment of duplicate utility service, prohibited under the existent statute.

TEXAS.—The Senate bill to establish a public utility commission will, in accordance with a committee decision made last week, exempt municipal plants from its provisions.

WYOMING.—Referring to an agitation started in Wyoming and supported by former Governor R. D. Carey to have that commonwealth cancel its previous adhesion to the Colorado River compact, Governor Frank C. Emerson said recently: "All I have to say is that there will be a fight. All the power and influence I can wield, if I have any, will be exerted to keep Wyoming in the compact that insures the building of Boulder Dam."

Submetering Fight in New York Waxes Warm

A published interview with M. S. Sloan, president New York Edison Company, on the submetering practice which he is endeavoring to have abolished by the New York Public Service Commission brought from Clarence J. Shearn, attorney for the Real Estate Board of New York and the Building Managers and Owners' Association, on Wednesday of this week a declaration that the "real object" of the Edison company in raising the submeter issue is "to obtain by indirection an increase in its wholesale rates." According to Mr. Shearn, as quoted in the press:

"Mr. Sloan persists in spreading the absolutely baseless idea that the owners of submetered buildings are profiteering at the expense of tenants. Constant reiteration of this false suggestion has doubtless persuaded the belief that it is a fact. There is not a shred of truth in it. Tenants are charged precisely the Edison company's published rate as fixed by the commission."

Despite the array of interests aligned against the electric companies, Mr. Sloan declared that he was determined to fight the matter to a finish. "I do not want to harm the property owners," he said. "My quarrel is with the submetering companies, and I think they should be done away with. I am against all forms of submetering. If it goes on so that $30,000,000 or $40,000,000 of our business is in the hands of these unregulated middlemen, as may happen if something is not done to check the practice, we may have to ask for higher rates."

Suggests the Scrapping of D.-C. Equipment

Philadelphia Engineer Makes This Recommendation at New York Edison Rate Hearings—New York City Challenges 1901 Valuation

WHEN the New York Public Service Commission met again on Monday of this week to take up the long-pending rate case affecting the New York Edison Company, Otto M Rau, consulting engineer of Philadelphia, continued his testimony, begun at the last previous hearing (ELECTRICAL WORLD, January 19, page 161). Mr Rau expatiated on the advantages that would accrue from the company's substitution of alternating current in those parts of the city where direct current is still used. Commissioner William R. Pooley, hearing the case, agreed with Jacob H. Goetz, counsel for the company, that a proposal of such a far-reaching nature did not belong in a rate hearing. Mr. Pooley remarked: "We are dealing with a plant as it now exists and not with a hypothetical plant."

Mr. Rau presented figures to show that the capital investment to produce the amount of energy now generated at the company's Duane Street plant would not exceed $1,250,000. According to the company's figures, he said, the plant was valued at $12,000,000. Mr. Goetz explained that plants of the Brooklyn Edison Company now furnished the power once supplied by the Duane Street plant, which, it was testified, was about 90 per cent dismantled.

The city, according to Assistant Corporation Counsel Joseph P. Morrissey, challenges the company's figure of $79,000,000 as of May 1, 1901, as representing the actual cost of the property that went into the merger of a group of smaller utility companies at that time. The actual cost of property that went into the figure, Mr. Morrissey said, was $23,000,000, about $60,000,000 being "water." The retirement of property in existence prior to 1901, he said, was $4,000,000, or 5 per cent, while the property retired since that time runs to 40 or 50 per cent.

P. G. & E. to Add Two Steam Units of 50,000 Kw. Each

Plans to add 100,000 kw. of steam generating capacity, in the form of two units, to its Station A plant in San Francisco are being made by the Pacific Gas & Electric Company. Preliminary plans call for two 50,000-kw. compound units operating under approximately 1,400 lb. steam pressure. These will replace two small units totaling about 27,000 kva. in the present plant. Natural gas will be used as the nominal fuel, and with the size of the units and the high steam pressure involved it is expected that the plant will show unusually high economy. Plans call for the first unit to be in operation eighteen months after work is started

Engineers at Minneapolis

N.E.C.A. Technical Men Listen to Acceptable Advice—Co-ordinating Operating and Commercial Departments—Radio Interference Still a Live Topic

CONSCIENTIOUS and persistent efforts to meet dissatisfied customers at least half way will prevent the greater part of the complaints made to state regulatory commissions if E. H. Morris, chief engineer of the North Dakota Railroad Commission, is right. This was the opinion expressed by him at the third annual engineering conference of the North Central Electric Association, held at Minneapolis on January 21 and 22. To back up his statement, Mr. Morris said that of the complaints received by the North Dakota commission less than 5 per cent had any basis at all and only 2 per cent were justified.

Conspicuous success with an idea that is not new but has seemed more alluring than practical to many central-station merchandisers was recounted by C. J. Strike of the Northwest Public Service Company, Huron, S. D., in an address on "How Operating and Commercial Departments Can Co-ordinate Their Activities." Mr. Strike told interestingly how he persuaded operating men to consider themselves salesmen as well as meter readers, linemen and service men and described how they achieved really surprising results.

That the average distance traveled by a kilowatt-hour from generator to consumer was between ten and twenty miles was one point made by H. S. Bennion of the N.E.L.A. headquarters staff in his address on "Interstate Power." The small amount of energy that crosses state lines emphasizes the essentially local characteristics of the power industry he said, and leaves small argument for the supersession of state by federal regulation or for superimposing the latter on the existing situation.

E. C. Stone, chairman of the Engineering National Section, stressed the expanding functions of engineers in electric utility progress and offered to them five definite recommendations: that they seek to work out in practice the motto "more system capacity per dollar of investment," that they avail themselves of the valuable experience contained in serial reports, that they interest themselves in the regulatory code proposals now before the industry, that they analyze the performance characteristics of the systems they operate to the end that operating costs may be lowered, and that they make critical analyses also of system design and construction in order that the wide variations in costs now existing may be narrowed.

Speaking at the conference banquet, L. W. W. Morrow, editor of the ELECTRICAL WORLD, said that the time had now come for the engineer to take stock of what he was doing, to forsake the path of expedience that heretofore was the only road open to him and to consider the building of electrical systems with strict regard not only to the technical but to all the essential factors. Mr. Morrow gave a brief but illuminating sketch of the work of the new power system engineering committee, of which he is chairman. This committee will attempt to set up in logical and comprehensive fashion the factors that determine system design so that central stations may develop their systems according to orderly and coherent programs fixed by operating conditions.

A day of well-attended and interested group discussions kept the 219 engineers present at the conference occupied right up to the close. One subject that appeared to have invaded the deliberations of all of the committees, even the one on hydraulic power, was radio interference. This problem, judging from the animated discussion it provoked, is still far from a solution, particularly in regions distant from high-powered broadcasting stations where receivers must be operated at high sensitivity.

So many subjects of discussion were developed that it was decided to devote in future considerably more time to a "clearing house" of ideas, with more adequate provision for impromptu speakers, Secretary J. W. Lapham said. He told the opening session that the light and power companies of the Northwest spent nearly $12,000,000 for construction and replacements in 1928.

Rural Conference at Minneapolis Records Successes

Much evidence was presented at the rural electric service conference held at Minneapolis January 28 and 29 under the auspices of the North Central Electric Association that electricity intelligently and liberally used on the farm will cut labor costs and increase revenue and thus prove an excellent investment for the farmer. Prof. E. A. Stewart, formerly of the University of Minnesota, presented as the director of the Red Wing experimental project a statement showing that the financial condition of the Red Wing farms began to improve from the day electricity was first employed and that this improvement has continued steadily through a period of more than four years, with the end not yet in sight.

Prof. R. A. Patty, South Dakota State College, reported on the Renner experimental line, declaring that while he had not made an economic survey, he was positive that electricity had been used so profitably that it represented no real expense to the farmers. H. A. Shimmelpfenig, a Minnesota poultry farmer whose electric bill runs over $100 a month, described in detail how this expense is far more than offset by increased efficiency of operation.

The meeting was the second of a series of geographic division rural conferences held in co-operation with the rural electric service committee of the National Electric Light Association. It was attended by 150 individuals, including power-company executives, company rural field men, agricultural press editors, country press editors, farmers, representatives of agricultural colleges and manufacturers of farm, barn and electric equipment. The keynote of the meeting was the establishment of ways and means to make electricity consumed in considerable quantities a profitable investment to the farmers.

Among other speakers besides those already mentioned were Charles F. Stuart, chairman of the rural electric service committee of the N.E.L.A.; Director E. A. White of the Committee on the Relation of Electricity to Agriculture; R. F. Pack, vice-president Northern States Power Company; J. F. Reed, chairman of the state electric-agricultural committee; Dr. J. T. E. Dinwoodie, editor *Dakota Farmer;* David Gustafson, implement dealer; Andrew Nelson, Westinghouse company and John Pike, General Electric Company.

Purchases and Mergers

U.G.I. Buys Into General Gas & Electric—Utilities Service Company to Buy Plant at Hilo, H. T.—Georgia Power Accepts Cartersville Offer

ANNOUNCEMENT was made late last week by John E. Zimmermann, chairman of the executive committee of the United Gas Improvement Company, that the company has purchased, through a subsidiary, substantial blocks of the securities of the General Gas & Electric Corporation, which corporation controls the public utilities operating in New York, New Jersey, Pennsylvania, Maryland, South Carolina and Florida that are managed by W. S. Barstow & Company, New York.

Organized less than a year ago, soon after the purchase of the Suburban Light & Power Company of Cleveland, by E. W. Sweezy and others, and at the present time controlling about fifty Ohio utilities of all kinds, including some electrical systems in the northern part of the state, the Utilities Service Company of Alliance expects to add the Hilo (Hawaii) Electric Light Company to its chain of subsidiaries within the next three months. Hilo, the second largest town in Hawaii, has a population of 15,000, and its hydro-electric plant serves about six thousand customers. The purchase price will be about $2,000,000.

The Georgia Power Company has accepted the offer of the city of Cartersville to sell it the local electric and gas properties and franchises for the sum of $460,000, subject to several conditions, one of which is that the power company must build a dam, with a 60,000-hp. generating unit, on the Etowah River, 5 miles from Cartersville. Approval of the Legislature is necessary, and the proposal may be sent to a public vote by it.

The Tide Water Power Company of Wilmington, N. C., has obtained options to purchase the electric properties owned by the Carolina Gas & Electric Company in the vicinity of Kinston and New Bern, N. C. These properties consist of about 90 miles of rural transmission lines. Power is now being purchased from the municipal plants in Kinston and New Bern.

N.E.M.A. Asks for Tariff Revision by Extra Session

Among business transacted by the National Electrical Manufacturers' Association at its midwinter meeting in New York last week, reported in part in last week's issue (page 211), was the adoption of a resolution indorsing the plan of an extra session of Congress as soon after March 4 as possible for the purpose of general (not partial) tariff revision. In this connection a third recommendation made by the association's tariff committee, in addition to the two noted in these columns last week, is of interest. The committee said:

The N.E.M.A. believes it was the intention of Congress in writing the clause "all other machines or parts thereof," etc., this being in the metal schedule, to mean the *metal* parts thereof. The court, however, has interpreted this clause to mean any article, finished or unfinished, which eventually would become part of the machine. This has wrought great injustice to many lines of manufacture, in placing articles formerly classified under different paragraphs of the metal schedule, such as woven wire cloth, and also under different schedules, such as manufactures of wool, manufactures of porcelain, manufactures of glass, etc., under the machinery paragraph, 372. We would, therefore, recommend that after the words "all other machines or parts thereof" in paragraph 372 the following clause be inserted: "if composed wholly or in chief value of metal."

With the three suggested changes, paragraph 372 would, as regards the clause amended, read as follows, the new part being in italics:

Reciprocating steam engines and steam locomotives, 15 per centum ad valorem; . . . *electrical machines and apparatus, used in producing, utilizing, applying, controlling or modifying electrical energy or force, not specially provided for, and parts thereof, if composed wholly or in chief value of metal, 40 per centum ad valorem;* all other machines or parts thereof, *if composed wholly or in chief value of metal,* finished or unfinished, not specially provided for, 30 per centum ad valorem.

Northern States Power's 1929 Expansion Program

Approximately $8,000,000 will be expended during 1929 to improve the service and properties of the Northern States Power Company in Minnesota, Wisconsin and the two Dakotas. No outstanding single project is under consideration for the coming year, though it is possible that a new office building may be erected in St. Paul. A large share of the $8,000,000 will be spent on electrical properties recently acquired, according to R. F. Pack, vice-president and general manager of the company, especially in the Minnetonka (Minn.) district, where the distributing system will be reinforced and the 60,000-volt line between Glen Lake and Waconia and the 13,000-volt line between Glen Lake and Hopkins will be increased in capacity.

Improvements for Minneapolis and St. Paul include an underground conduit on the Cedar Avenue bridge between the two cities and the completion of the company's new office building in Minneapolis. There also will be a new substation to serve the Nokomis district. In the St. Paul downtown district a low-voltage alternating-current network will be installed, and a new substation will be built at Red Rock. Provision is made for rebuilding transmission lines in the Faribault, Mankato and Stillwater (Minn.) divisions, and in the St. Cloud and Montevideo (Minn.) divisions and in Wisconsin new lines will be erected and existing ones improved. Better service will be provided also in the Dakotas.

Ontario Municipal Electric Men Debate Publicity

At the annual meeting of the Ontario Municipal Electric Association, held in Toronto January 23, much consideration was devoted to combating the anti-public-ownership efforts of private corporations and to the alienation of immense water-power rights on the St. Lawrence. A resolution was unanimously adopted to the effect that funds should be put at the disposal of the Hydro-Electric Power Commission of Ontario for the diffusion of information as to its operations and matters of interest to the hydro municipalities and that legislation be asked to enable funds for publicity purposes to be appropriated.

Another resolution expressed the view that nothing should be done with the Beauharnois power proposal for the development of power on the St. Lawrence until the courts had decided the question of power ownership as between the Dominion and the provinces. The meeting expressed itself in favor of the preservation of the London (Ontario) home of the late Sir Adam Beck as a hydro museum and the erection by the Dominion government of a suitable memorial to Sir Adam at Baden, Ontario, his birthplace. The following officers were elected: President, C. A. Maguire; vice-presidents, Willoughby Ellis of Hamilton, August Lang of Kitchener and Fred Newman of Picton; secretary-treasurer, T. J. Hannigan.

Licensing of Electrical Marine Operators Considered

Licensing of electrical operators to provide for the efficient care of electrical machinery on shipboard is still being advocated. The subject will be considered by the Board of Supervising Inspectors of the United States Steamboat Inspection Service, according to a circular letter being sent to owners of electrically governed craft by Supervising Inspector-General D. N. Hoover. This board believes that a careful study should be made with a view to determine whether the time has come for the licensing of electrical operators to take care of the equipment on vessels under the jurisdiction of this service.

Inspector General Hoover said recently that his office is making a thorough and searching investigation of the needs of the merchant marine in this respect and is asking steamship and steamboat operators to express their opinion and to report any failures or accidents that have occurred as a result of electrical equipment not being properly cared for.

Rate Proceedings Ordered for Baltimore Company

The Maryland Public Service Commission last Friday issued an order for an investigation to determine rates to be charged by the Consolidated Gas, Electric Light & Power Company of Baltimore for gas and electric service. Speculation in the common stock of the concern has been heavy in Baltimore and New York, and Chairman H. E. West admitted that this was one reason for the commission's order. He said the hearings would begin as soon as possible, full consideration being given to the contention that rates should be settled before the end of June.

Herbert A. Wagner, president of the company, said he had no statement to make. He explained that it was the usual thing for the commission to do when the time fixed by it for consideration of rates draws near. He also declared that there was no evidence of outside interests trying to buy their way into the company and that if the company entered into a contract to supply energy for the Pennsylvania Railroad, the maximum demand would be 50,000 hp. but the yearly average much less.

Electro-Gravitational Theory Arouses Interest

No little interest in electrophysical circles in this country was aroused last week by the announcement that a new book by Albert Einstein would be off the press in the near future. According to Berlin press dispatches, the coming work, which is very short, reduces to one formula the basic laws of relativistic mechanics and of electricity.

The new theory, as explained by Dr. Hans Reichenbach, a professor at Berlin University, maintains that there is only one substance—namely, "the field"—and only one universal physical law. The field contains electric and gravitational components, all of which are linked into a single formula. Einstein, says the professor, is able to show that all existing physical laws can be derived from this universal formula. This means subordination of the former separated spheres under one higher law.

The new formula, however, accomplishes much more, according to Professor Reichenbach. It describes the existing theory of separated systems as a special case and gives new information about the relation of gravitation and electricity in more complicated fields. Therefore it is of more than only formal significance. It proves the existence of the influence of gravitation on electrical processes and *vice versa*.

Briefer News

EMBARGO ON COLORADO RIVER DEVELOPMENT EXTENDED.—An extension of the law precluding the issuance of water-power permits or licenses on the Colorado River was approved by the Senate January 26. This resolution excepts the Gila River and its tributaries and makes the order effective until the Boulder Dam act is carried out.

BIRMINGHAM ELECTRIC COMPANY'S PROGRAM FOR 1929.—Although the Birmingham Electric Company is not planning any large construction projects in 1929, it will spend more than $1,500,000 during the year, according to an announcement made by Vice-President J. S. Pevear. One million dollars will cover normal growth and the remainder is to be expended for the renewals and replacements.

MINIMUM CHARGE FOR DOMESTIC CUSTOMERS HALVED IN MONTANA.—The Montana Power Company, Great Falls Power Company and Thompson Falls Power Company of Montana have announced that, effective as of February 1, the minimum charge for lighting, cooking and heating in homes will be reduced from $2 to $1. The new rate does not apply to hotels and rooming houses.

PROGRESS OF NEW HAMPSHIRE PUBLIC SERVICE COMPANY'S NEW TRANSMISSION LINES.—Completion of the 35-mile, 66,000-volt transmission line from Ayres Island to Lincoln, N. H., has been reported by the Public Service Company of New Hampshire. Work is going forward on the Ayres Island-Garvins Falls line project, wire having been strung south as far as Franklin. The final wire-stringing work on the 66,000-volt line from Greggs Falls to Nashua also is proceeding.

RATE CUT FOR BEVERLY, MASS.—A substantial reduction in the first two room-rate brackets of the Beverly Gas & Electric Company was ordered last week by the Massachusetts Department of Public Utilities, concluding a pending case of long standing. Present rates are 11 cents net per kilowatt-hour for the first 3 kw.-hr. per room per month, 9 cents for the next 5 kw.-hr. and 4 cents for any excess. Effective February 15, the first two rates will be 10 cents and 6 cents.

BUFFALO GENERAL ELECTRIC COMPANY TO PUT BEACON LAMPS ON ITS TOWER.—A beacon light to aid aviators will be operated by the Buffalo General Electric Company on the tower of the Electric Building, owned and occupied by it. This beacon, it is said, will be visible 75 miles away. The beacon will be 300 ft. above street level. It will consist of four 24-in. flashing searchlamps, one stationary, casting a white beam of light straight in the direction of the airport, the other three red, blue and amber respectively. This light will burn from sunset to sunrise every day in the year.

TOLEDO EDISON ORDERS ANOTHER LARGE MACHINE.—The Toledo Edison Company has ordered a 35,000-kw. frequency changer for its Acme power plant at a cost of $550,000. This and the new turbine being placed in the plant are the main items in the company's three-million-dollar 1929 expansion program, already noted. The company soon will complete its high-tension transmission line between Toledo and Sandusky, tying in with the Ohio Public Service lines.

COLUMBUS (OHIO) CITY COUNCIL REJECTS COMPANY BID.—The City Council of Columbus, Ohio, has rejected a bid from the Columbus Railway, Power & Light Company to sell power to light the streets and municipal buildings and for pumps and other municipally operated equipment at a rate of 7½ mills per kilowatt-hour delivered at the municipal plant switchboard, a rate slightly lower than the present cost. Mayor Thomas, who favors a bond issue to enlarge the municipal plant, said: "I consider it an attempt to put the city plant out of operation."

SPRINGFIELD, MASS., CONTRACTS FOR ITS NEW HYDRO PLANT.—Plans for the power house and substation of the municipal hydro-electric plant to be erected for the city of Springfield, Mass., by the Turners Falls Power & Electric Company are being prepared by Arthur A. Smith, engineer. Work on the power-house substructure and substation foundations is scheduled to begin in April, work on the substation in August and work on the power-house in September. The I. P. Morris Corporation of Philadelphia will supply the waterwheel, the General Electric Company the transforming and switching equipment, and the Westinghouse Electric & Manufacturing Company the generators.

HOUSTON GETS $100,000 AS HALF SHARE OF COMPANY'S EXCESS PROFITS.—A check for $100,000 was given to the city of Houston, Tex., as part of its share in the Houston Light & Power Company's excess profits for 1928. The total amount to be paid the city will be around $120,000. Mayor Holcombe thinks. Last year the company paid $101,000 to Houston. Under the profit-sharing agreement, the company pays half of its excess profits into the city treasury. The light firm is allowed 8 per cent return on its investment and 4 per cent for depreciation.

EASTERN SHORE PUBLIC SERVICE COMPANY ADDS SEVEN TOWNS IN THREE STATES TO ITS LINES.—The Eastern Shore Public Service Company has recently added to its lines Goldsboro and Bishopville, Md.; Kenton, Del., and Dalbys, Capeville, Cheapside and Townsend, Va. A third boiler has just been installed in the recently completed annex to the company's Vienna (Md.) plant, bringing the station's total generating capacity to 15,000 kva. The annex contains an additional 7,500-kva. turbine, made necessary by increased demand. At Exmore, Va., the company is adding a small unit.

TO VOTE ON EAGLE PASS (TEX.) HYDRO PLANT.—An election will be held February 8 in Maverick County (Tex.) Water Improvement District No. 1 to vote on issuing $1,800,000 in bonds, to be used for the construction

Seven Sisters Falls Plant to Be Largest in Manitoba

GOOD progress is reported in connection with the construction of the Winnipeg Electric Company's big power plant at Seven Sisters Falls, on the Winnipeg River. This plant will be one of the most modern of its kind and will be the largest in Manitoba. It is designed for an ultimate installation of 225,000 hp. in six units of 37,500 hp. each, under a head of 66 ft. Work is now under way on the power plant, and in due course a 75-mile double-circuit steel tower 110,000-volt transmission line, together with a new terminal station, will be constructed. It is planned to have three units in operation under partial head before 1931.

The plant is being built by the newly organized Northwestern Power Company, a subsidiary of the Winnipeg company, and its ultimate cost is put at $20,000,000.

of the proposed 10,000-hp. hydro-electric plant near Eagle Pass in connection with the large irrigation project already provided for by voting $4,800,000 in bonds. The water will be taken from the Rio Grande and will irrigate 60,000 acres of land after it has served the hydro-electric plant. The energy will be sold to the Central Light & Power Company and transmitted over a large stretch of territory in the central Rio Grande border region.

FLINT, MICH., NOW BOASTS 30,000-KVA. CONDENSER.—Not since the interconnection with the Detroit Edison Company has so much interest been displayed by the Consumers Power Company engineers and operators as in the addition a few weeks ago of a Westinghouse 30,000-kva. synchonous condenser at the Garfield Avenue substation in Flint, Mich. Its installation is the first experience of the company with the operation of such equipment in stations connected directly to the system. It is also the second largest unit in service on the system, ranking right after the 37,500-kva. turbo-generator at the Saginaw River steam plant. Similar synchronous-condenser installations are now under consideration for other stations on the Consumers Power system.

ST. PAUL COUNCIL QUESTIONS NORTHERN STATES POWER COMPANY RATES.—After hearing a report by City Commissioner Otto W. Rohland of St. Paul that the Northern States Power Company's valuation of its property in St. Paul, slightly less than $44,000,000, is "more than twice the amount we had reason to expect," the City Council has authorized Mr. Rohland to employ experts to make an independent appraisal. His report was on a preliminary analysis of the power company's valuation figures recently submitted to the city in connection with the study of the fairness of existing rates for electricity, gas and steam. Should the Council's investigation lead it to determine that present rates are yielding the company too high a profit, it will seek a reduction.

ALLIED POWER & LIGHT FORMS INDUSTRIAL DEVELOPMENT DEPARTMENT.—The Allied Power & Light Corporation, which represents merged interests of Hodenpyl, Hardy & Company and Stevens & Wood, Inc., has formed an industrial development department. This department will co-operate with and supplement activities of commercial organizations operating in the various local communities served by companies with which the Allied Power & Light Corporation is identified. Work of this character has been carried on for several years by various operating companies. The new department not only will serve to consolidate the activities of such companies but will provide a central clearing house and will make available to each community expert engineering and economic advice and data for directing industrial promotion efforts along constructive and effective channels

FURTHER DETAILS OF ST. LOUIS COMPANY BUDGET.—The fourteen-million-dollar 1929 program of the Union Electric Light & Power Company of St. Louis includes as its main item the 75,000-kw. turbo-generator to be added, as already reported, to its Cahokia power plant, from which a 35,000-kw. generator will be removed for installation at the Venice (Ill.) plant. Another important undertaking will be the raising of the levees to provide additional safety for the Cahokia plant. This will cost $2,750,000. The substation at Fourteenth Street and Clark Avenue, St. Louis, to serve customers in the vicinity of the proposed Municipal Plaza, will be completed. Outside the St. Louis district $200,000 will be spent for new transmission lines at Keokuk. Transmission lines, cables, poles, transformers, meters and utility equipment will be added throughout the Mississippi River properties, which extend from Iowa to southern Missouri. Transmission lines will be added in East St. Louis. Six additional cables will be laid under the Mississippi River at a cost of $100,000.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Artistic Lighting Equipment Association and Illuminating Glassware Guild—Cavalier Hotel, Virginia Beach, Norfolk, Va., Feb. 6-8. G. P. Rogers, 420 Lexington Ave., New York.

Pennsylvania Electric Association—Commercial Section, Schenley Hotel, Pittsburgh, Feb. 7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

New England Division, N.E.L.A.—Engineering Section, Hotel Statler, Boston, Feb. 13-14. Miss O. A. Bursiel, 20 Providence St., Boston.

New Mexico Utilities Association — Franciscan Hotel, Albuquerque, Feb. 18-20. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

North Central Electric Association — Commercial Section, Minneapolis, Feb. 25 and 26. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Iowa Section, N.E.L.A.—Operators' Section, Sioux City, Feb. 26-27. H. E. Weeks, Davenport, Iowa.

Northwest Electric Light and Power Association — Commercial Section, Spokane, Wash., Feb. 28 and March 1; Engineering Section, Walla Walla, Wash., March 25-27. Berkeley Snow, 1206 Spalding Bldg., Portland, Ore.

Oklahoma Utilities Association — Huckins Hotel, Oklahoma City, March 12-14. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City.

American Institute of Electrical Engineers—Regional meeting, Cincinnati, March 20-22; regional meeting, Dallas, Tex., May 7-9. F. L. Hutchinson, 33 West 39th St., New York.

Arizona Utilities Association—El Conquistador Hotel, Tucson, April 18-20. Lee C. McCullough, 134 South Central Ave., Phoenix.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Eastern Central Division, N.E.L.A.—Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

CITY OF BALTIMORE AND PENNSYLVANIA RAILROAD IN DEADLOCK REGARDING OVERHEAD TRANSMISSION. — A deadlock has been reached in the negotiations between the Pennsylvania Railroad and Baltimore officials over the railroad's tunnel and terminal proposals in that city, which form part of its scheme of electrification between New York and Washington. The chief issue is that of overhead versus underground installation of the power lines, which must cross the city. The railroad sticks to its original contention that underground transmission is impracticable, and the Mayor's advisory commission, of which Prof. J. B. Whitehead of Johns Hopkins is a member, is drafting a report insisting that overhead transmission will not be acceptable.

APPLICATION FOR GOSHEN PASS HYDRO PLANT MADE IN VIRGINIA.—Application to the State Corporation Commission of Virginia for a license to build a concrete dam, 63 ft. high and 450 ft. long, across the North River at the north end of Goshen Pass, 8 miles south of Lexington, has now been filed by the Virginia Public Service Company. The site is in Rockbridge County just below the junction of the Big Calf Pasture and the Little Calf Pasture Rivers. The dam will back water up 5.2 miles. A pressure conduit about 11,400 ft. long will convey water from the North River to the penstocks. A power house with two 8,000-hp. vertical reaction turbines will be erected at Wilson Springs, near the south end of Goshen Pass. As before reported vigorous protests against this plant are being made by scenery preservationists. Hearing on the petition is set for February 28.

PORTLAND ELECTRIC POWER COMPANY'S PLANS FOR OAK GROVE PLANT.—Characterizing the year 1929 as a light one in capital expenditures for his company, Franklin T. Griffith, president Portland (Ore.) Electric Power Company, announces a budget of $1,600,000 for the electrical department. Much of this will cover the normal expenditure on transmission, transformation and distribution. The balance is to be spent on the foundation for a second 35,000-kw. unit at the Oak Grove hydro-electric plant, the first unit of which was put in operation in 1924. Installation of the second unit is expected in 1930. A third and final unit will follow at a time not now determined. To operate all three at rated capacity will require bringing additional water by tunnel from the Oak Grove Fork of the Clackamas to the

Upper Fork and a second flow line from the intake to Cripple Creek Knoll. The unit contemplated for 1930 can be operated at approximately half capacity most of the year with the surplus water through the existing flow line.

CENTRALIA, WASH., PLANS CITY HYDRO PLANT.—The City Commission of Centralia, Wash., plans to build a hydro-electric plant in the Nisqually River about 4 miles above McKenna. A canal would carry the water 9½ miles to a point 3 miles below Yelm, where there is a drop of 208 ft. to the water's level. The power house would be erected at this point, with a 5,000,000-gal. reservoir. Two generating units of 2,500 hp. each would be constructed at first, one to be used as a reserve, but the canal and power house would be of sufficient size to generate 11,000 hp. when needed.. The estimated cost is $950,000. There is a balance of $300,000 in the city's light fund, which would necessitate a bond issue of $650,000. The bonds would be paid from revenue.

RAQUETTE RIVER, N. Y., TO BE SITE OF NEW HYDRO PLANT.—The first unit of what will be the largest hydro-electric power development of the Carlisle interests in northern New York, to be built on the Raquette River at South Colton, will be started next spring by the Power Corporation of New York, according to announcement made at Watertown, N. Y., last week. The plan calls for a 12,800-hp. development, with provision for tripling the installation when water storage is obtained. This will be the first development on the Raquette in the eight-mile stretch between Stark and South Colton, where a potential output of 225,000 hp. is thought to exist. The plans call for a concrete dam 50 ft. high and 1,000 ft. long, with the power house 900 ft. from the dam. A net head of 78 ft. will be developed at South Colton. The plant is to be completed early next year.

ARKANSAS POWER & LIGHT WILL BUILD ANOTHER PLANT ON THE OUACHITA.—The Arkansas Power & Light Company will construct a second dam and hydro-electric power plant on the Ouachita River about 5 miles south of Hot Springs, Ark. The estimated cost of the project is $6,175,000. The new plant will be rated at 53,333 hp., and two turbines of 20,000 kw. capacity each will be installed. The dam and power plant will be of reinforced concrete. C. S. Lynch engineer for the company, will be in direct charge of the construction work, which will be done with company forces. Other construction includes a 110,000-volt line between Carpenter and Little Rock, one 33,000-volt and one 110,000-volt line from Carpenter to Remmel, ten miles, and raising the capacity of the 33,000-volt line from Remmel to Bauxite and Little Rock to 110,000 volts and of the 33,000-volt line between Pine Bluff and Little Rock to 66,000 volts.

Recent Court Decisions

UTILITY COMMISSION MAY STRIKE OUT RATE SCHEDULE WHICH VIOLATES VALID ORDER MADE BEFORE EFFECTIVE DATE OF SCHEDULE.—In Columbus, Delaware & Marion Electric Company vs. Public Utilities Commission of Ohio, the Supreme Court of that state has ruled that when an arrangement entered into between the company and another was approved by the commission and no claim of error was filed by the company, which, however, did subsequently file a schedule not in conformance with the commission's order, the commission had authority on its own motion to strike the new schedule from its files. (163 N.E. 914.)*

ASSIGNEE OF CONTRACT BY WHICH ONE CITY FURNISHED ENERGY TO ANOTHER IS ENTITLED TO ITS PERFORMANCE.—In 1912 the city of Quenemo, Kan., entered into a contract with the city of Lyndon to supply electrical energy to the latter. After three years Quenemo sold its distributing plant and assigned the contract to the Municipal Power Transmission Company, which continued to supply energy to Lyndon for two years. Then Lyndon undertook to repudiate the contract, and the company brought suit against the city. The Supreme Court of Kansas held that the contract remained valid and that the plaintiff was entitled to its performance. (272 Pac. 158.)

OREGON CITIES MAY GO OUTSIDE CORPORATE LIMITS AND COMPETE WITH PRIVATE COMPANIES.—The Supreme Court of Oregon holds that a municipality owning and operating its own electric system may extend transmission lines outside of corporate limits and serve customers in competition with privately owned utilities. This opinion, anxiously awaited, was rendered in the case of the Yamhill Electric Company vs. City of McMinnville, wherein the plaintiff sought to enjoin the municipality permanently from invading operating territory beyond the city limits and in direct competition with the private company. In commenting upon the principle involved in the suit, Justice McBride said: "That permitting cities to engage in the business of selling light and power outside of their corporate limits without a central supervision of their activities will tend to stifle private enterprises goes without saying. That such a venture by the city of McMinnville may have proved financially profitable to the municipal treasury and will have a tendency to induce other municipalities to attempt like ventures is not improbable. What the city of McMinnville is doing or attempting to do other cities may also do, and we have at least a possibility of half a dozen towns competing with each other for the business of the surrounding country without any central authority to confine them within reasonable business limits. It is usually easy to vote bonds for such speculative purposes, especially where a considerable portion of the community are non-taxpayers or merely nominal taxpayers." Referring to the matter of surplus power, the justice says: "The question of surplus power or energy cuts no figure. It seems most probable that the alleged 'surplus' is simply electrical energy created for the very purpose for which it is being used, namely, for sale for profit and to increase the funds in the city treasury. That this may be a special benefit to the taxpayers of McMinnville, tend to reduce the rates for light and power to its citizens, and increase its sinking fund for the redemption of bonds, if it has issued any, is probable. But, if the business is conducted for 'profit,' the law allows the city so to conduct it. That such a course will be regretted, and is in the long run bad economic policy, is, in the opinion of the writer, speaking for himself and not for the court, inevitable, but we are not here to decide this case upon our private views of economics but upon the law as it is written." Utility operators view the decision with alarm, fearing deliberate invasions of territory, discriminatory advantages to municipal operators while the private operator must continue to submit to state regulation, and the issuances of unlimited securities by incorporated cities for financial support of their utilities while private operators must still limit their financing activities.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

RATES LIKELY TO ANTAGONIZE SMALL CONSUMER DISCOURAGED.—In adjudicating a complaint against the rates of the New York & Queens Electric Light & Power Company, the New York Public Service Commission touched on the impolicy of adopting rates of a nature likely to antagonize the small consumer. Dismissing the complaint, made by a rather large industrial consumer who sought reduced electric rates in that class of service, the comission said: "Any change looking forward to maintaining the same revenues but placing the rate on the block method of increasing the first two blocks and decreasing the balance of the blocks over the present rates would not in itself be of much value as there are only a small number of consumers under this rate and the small users would naturally complain about their rates being increased and the matter would again be upset."

POWER LINE INTERFERENCE WITH TELEPHONES.—The Shell Pipe Line Company is an Illinois corporation engaged in the transmission of oil through that state. For its own purposes this company also conducts a telephone line extending along the highway paralleling the pipe-line route. Recently the Public Service Company of Northern Illinois applied for a certificate to construct and operate a power transmission line. It was found that the proposed line would be upon the same side of the highway as the industrial telephone line, creating a possibility of inductive interference which might result in the impairment of efficiency of the telephone line and also create a danger of contact between the different wires. The Illinois Commerce Commission announced the willingness of the pipe-line company to abandon its easement and relocate its telephones along a nearby railway right-of-way. The power company was, however, directed, says *Public Utilities Reports*, in the construction of its line where it became necessary to overbuild or engage in joint construction with existing telephone and telegraph wires, whether owned by a public utility or not, to construct in such a manner as to safeguard as far as possible the users of the telephone line.

News About Men of the Industry

W. F. Downs Heads Day & Zimmermann

W. Findlay Downs was elected president of Day & Zimmermann, Inc., and Day & Zimmermann Securities Corporation at a recent meeting of the board of directors. He succeeds John E. Zimmermann, resigned. Mr. Zimmermann recently was elected chairman of the executive committee of the United Gas Improvement Company and has been functioning as chief executive since the vacancy in the office of president. Control of Day & Zimmermann, Inc., and subsidiary companies was acquired by the United Gas Improvement Company in 1926.

Mr. Downs received his technical

W. F. Downs

training at Lafayette College and at the Massachusetts Institute of Technology. After leaving college, he engaged in forestry survey work in the Maine woods, and in 1910 he became a cadet engineer with the United Gas Improvement Company in Philadelphia, where he remained until 1912. He then was appointed assistant engineer in North Carolina and California on construction and report work for the J. G. White Engineering Corporation. Later he was engaged in valuation work on telephone property in New York and from 1915 to 1918 served as assistant engineer of the Public Service Commission of Pennsylvania.

Mr. Downs' association with Day & Zimmermann, Inc., began in 1919 in the capacity of report engineer. In 1921 he was made a director of the company and in 1925 was made president of Day & Zimmermann Foreign, Inc. In 1927 he was advanced to a vice-presidency of the company. Mr. Downs is a member of the A.S.M.E. and the Franklin Institute of Philadelphia.

M. V. Watson of Portland, Ore., is now manager of the Western States Utilities Company, one of the subsidiaries involved in the recent purchase of the properties of the General Power & Light Company, Chicago, by the Peoples Light & Power Corporation, New York. Mr. Watson also manages the Peoples West Coast Hydro-Electric Corporation and the Peoples California Hydro-Electric Corporation, two other subsidiaries of the Peoples Light & Power Corporation.

Lawrence R. Wilder has resigned as a director of the American Brown Boveri Electric Corporation. Mr. Wilder was the organizer of the corporation and formerly its president.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, has left for his winter holiday in the South and will not return until the end of March.

Earl Whitehorne, commercial editor of Electrical World and editorial director of *Electrical Merchandising* and *Radio Retailing*, has just been elected president of the Electrical Board of Trade of New York. Earlier in the month he was re-elected president of the New York Electrical League, which puts him at the head of the co-operative industry activities of the metropolis. A movement is now afoot to bring about a consolidation of these two organizations and expand the work to embrace an active program of market development and a more progressive leadership in local electrical affairs.

R. A. Brackett, for about ten years connected with the industrial division of the Westinghouse Electric & Manufacturing Company, New England division, Boston, recently resigned to become assistant to the president of the Spencer Turbine Company, Hartford, Conn. Mr. Brackett received his electrical engineering training at Wentworth Institute and supplemented this with the student training course of the Westinghouse company at East Pittsburgh. Later he was employed by the Public Service Company, Freehold, N. J., leaving that company to enter the Westinghouse New England division in Boston.

Fred W. Hoover, formerly vice-president of the Consumers Power Company and more recently associated with Hodenpyl, Hardy & Company, Inc., has established headquarters at Jackson, Mich., with the purpose of directing the new industrial development department organized by the Allied Power & Light Corporation. Mr. Hoover will have at his disposal the expert engineering resources of Stevens & Wood, Inc., a subsidiary of the Allied Power & Light Corporation, specializing the major engineering and construction projects. This department will co-operate with and supplement activities of commercial organizations operating in the various local communities served by companies with which the Allied Power & Light Corporation is identified.

W. E. Wood Vice-President of Engineers Public Service

William E. Wood, president of the Virginia Electric & Power Company, was elected a vice-president of the Engineers Public Service Company at a meeting of the board of directors held January 24. A native of Aiken, S. C., and a graduate of the Georgia School of Technology, he was first employed by Stone & Webster in the Boston office for approximately a year. He was then sent to the Jacksonville Traction Company, where he worked in the various departments, eventually being made superintendent of transportation. After spending eight years in Florida he was transferred to the Houston Electric

W. E. Wood

Company, Houston, Tex., as superintendent of transportation, and subsequently became identified with the El Paso Electric Railway Company, the Galveston Electric Company and the Galveston-Houston Electric Railway Company.

It was in 1925 that Mr. Wood became identified with the electric light and power industry in Virginia when he entered the office of vice-president and general manager of the Virginia Electric & Power Company when control of the properties was taken over by Stone & Webster. In 1927 he was elected president of that company to succeed Luke C. Bradley. In the course of his career Mr. Wood has devoted considerable attention to association affairs. He engaged actively in committee work for the A.E.R.A. and served as president of the Southwestern Public Service Association.

Commissioner Edgar A. McCulloch, formerly chief justice of the Supreme Court of Arkansas, has become chairman of the Federal Trade Commission, succeeding Abram F. Myers, resigned. The new chairman will serve under the rule of rotation providing that each commissioner serve one year as chairman. In 1909 Judge McCulloch

was made chief justice of the state Supreme Court and continued in that position until February, 1927, when he was appointed a member of the Federal Trade Commission by President Coolidge. Since last March he has presided as commissioner in charge of all hearings in the investigation of power and gas utilities and will continue to act in that capacity.

C. I. Crippen Elected President of Iowa Utilities

C. I. Crippen, a vice-president of the American Electric Power Corporation, New York, parent organization of the Iowa Public Service Company, the Sioux City Gas & Electric Company and the Sioux City Service Company, has been elected president of the Iowa group to succeed Don M. Sterns, who retires as president to become chairman of the board of directors of the Iowa Public Service Company. Mr. Crippen has a broad background of experience in the public utility business in the Middle West, both in the operating and sales field. His first connection was in the manufacturing branch of the industry, in the electrical department of the National Tube Company, Lorain (Ohio) works, as special engineer in charge of tests and performance records. His work especially concerned the applications of electrical motors to steel mill drives and the introduction of the alternating-current motor to steel mill service. He entered the light and power field as power sales engineer for the Mahoning & Shenango Railway & Light Company, subsequently became head of the power sales department and later assumed charge of all sales. After serving as division manager of the West Penn Power Company, covering all West Virginia and Ohio, he returned to the Penn-Ohio System at Youngstown in charge of sales. He then became a member of the firm of Crippen & Funk, which led to his being placed in charge of the Youngstown office of Dwight P. Robinson & Company. Mr. Crippen again returned to the Penn-Ohio System as assistant to the vice-president and general manager covering all phases of operation.

J. E. North, chairman of the League Council, was elected president of the Electrical League of Cleveland at a meeting of the league's board of directors held January 14. Mr. North, who has been a prominent figure in the electrical industry, started his sixth consecutive term as league president.

William Stahl has been placed in charge of the industrial development work for the Penn Central Light & Power Company and others in Pennsylvania that are associated with it. These include the Keystone Public Service Company, the Edison Light & Power Company, the Chester Valley Electric Company and the Kennett Gas Company.

Obituary

Thomas Duncan

Thomas Duncan, founder and president of the Duncan Electric Manufacturing Company, died January 21 at Los Angeles, Calif., after an illness of several weeks. He was 63 years of age. Mr. Duncan was one of the few men who had seen almost the entire development of the electric meter and had been in intimate touch with all its phases. He was an inventor as well as an administrator and held about two hundred patents. Born and educated in Scotland, Mr. Duncan removed to America in 1883. Three years later he entered the works of the Sun Electric Company, Woburn, Mass., which at that time manufactured lamps, transformers and alternating-current generators. In 1887 he became connected with the Fort Wayne Jenney Electric Light Company

Thomas Duncan

and in 1890 he joined the meter department of the Thomson-Houston Electric Company at Lynn, Mass. At the close of the same year he returned to Fort Wayne to take charge of the meter-testing department of the Fort Wayne Electric Light Company and his first meters were put on the market in 1895.

Mr. Duncan became meter engineer for the Siemens & Halske Electric Company of America in 1898, designing a complete line of alternating-current and direct-current watt-hour meters. After the General Electric Company absorbed the Siemens-Halske Company he organized the Duncan Manufacturing Company and in 1901 began manufacturing at Lafayette, Ind. Mr. Duncan was a member of the American Institute of Electrical Engineers, the Franklin Institute of Philadelphia, the American Electrochemical Society and the American Association for the Advancement of Science.

Rodney Morrison, Jr., Southern district manager of the National Carbon Company with headquarters in Atlanta, Ga., died January 11, at the Fifth Avenue Hospital in New York, following an operation. Mr. Morrison had been connected with the National Carbon Company for about ten years prior to his death, having been transferred to Atlanta four years ago from the Cleveland office of this company. Mr. Morrison was 41 years of age, a native of Philadelphia and a graduate of the University of Pennsylvania.

Charles G. Bechel, for the last 23 years chief adjuster in the law department of the Commonwealth Edison Company, died recently at the West Suburban Hospital, Chicago, after a short illness. Mr. Bechel was born in Chicago 65 years ago.

James J. Doyle, president of the Annapolis & Chesapeake Bay Power Company and of the Washington, Baltimore & Annapolis Electric Railroad, died suddenly at his home in Baltimore January 19. Mr. Doyle was considered an expert on electric railway transportation problems and was well known in other utility circles. He was born in Cleveland 53 years ago, but he had made his home in Baltimore since joining the staff of the railroad in 1907.

Ogden Mills, well known financier, died at his home in New York January 28 following an illness of more than three weeks. Mr. Mills was a native of Sacramento, Calif., and a graduate of Harvard University. Following graduation he became interested in many of his father's enterprises. At the time of his death he was a director of the Niagara Falls Power Company, the Portland Electric Power Company, the New York Central Railroad, in addition to serving on the directorate of numerous industrial corporations.

William O. Wood, vice-president of Waterbury Cable Service, Inc., New York and Chicago, and widely known in the public utility industry, died January 21 at his home in Jackson Heights, L. I., after a short illness. Mr. Wood had for many years been identified with railroads and electric railways in New York, the South and the Middle West, having been for fifteen years president and general manager of the New York & Queens County Railway Company. He was born in Evansville, Ind., in 1870.

Edward Andrew Batwell, public relations director for the Puget Sound Power & Light Company, Seattle, Wash., for the last twenty years, died at his home in that city on January 12. Born in Michigan in 1860, Mr. Batwell led an eventful life, which included in its activities architecture, daily newspaper work, dramatic criticism, theatrical management and finally his long connection with the Puget Sound Power & Light Company. He joined the Seattle Electric Company in 1908 and remained with the company when the name was changed to Puget Sound Power & Light Company. An important feature of his work was the publication of the company's official monthly journal.

Financial and Statistical News

Utility Stocks Assume Active Market Leadership

Several New High Points Established—Bond & Share Makes Spectacular Rise—United Corporation Actively Traded

TAKING active leadership in the securities markets, a substantial number of utility stocks established new high levels this week. Although the spectacular activities of Bond & Share and Electric Investors created the center of interest, the market had many other features among utility common stocks. The entire list seems disposed to move upward on any favorable piece of news. The old standards by which the value of a stock was once arrived at seem utterly forgotten.

The stocks associated directly or indirectly with the recently formed United Corporation were also a center of interest. United Corporation units are being actively traded over the counter at more than thirty points above the issue price. American Superpower A and B stock have shown the largest rise of any of the group. Superpower, presumably, will be the largest holder of United Corporation stock. United Gas Improvement has established a new high. The rumored exchange basis between U. G. I. and United Corporation is that for every share of United Gas Improvement turned in there were issued in exchange five shares of United Corporation, valued at $25 per share, or a total of $125. Also, ⅞ of a share of United Corporation $3 preference stock, valued at $50 a share, or $43.75 for the ⅞ share, bringing the total to $168.75, and in addition warrants to subscribe to common stock.

General Gas & Electric has been another active issue owing to the statement that United Gas Improvement was accumulating that company's stock through its subsidiary, Gas Securities Corporation. Both classes of General Gas & Electric stock established new highs, as did also Engineers Public Service and Electric Power & Light. Allied Power & Light, listed on the Produce Exchange, has shown steady appreciation to over 40, which is double its list price of a few months ago.

Customers Invested $8,360,000 in November

On the basis of reports received by the ELECTRICAL WORLD from individual companies, sales of stock locally throughout the United States during November are estimated at 113,900 shares valued at $8,360,000, in 15,900 transactions. Not only were the aggregate sales comparatively small, but the average per transaction. $525, was somewhat less than usual.

Only two companies reported sales exceeding $1,000,000; one closely approached that figure and only one other passed the $500,000 mark. Evidently the conditions which have for some time been deterring activity in this field are continuing to prevail; sales efforts are confined to a relatively small number of companies. Breaking away from the prevailing custom of selling preferred stock, one company reports about $30,000 in very low-priced common.

Public Service of New Jersey to Issue Rights to Shareholders

Holders of common and 8 per cent cumulative preferred stock of the Public Service Corporation of New Jersey of record January 31 are to receive the right to subscribe to common stock of the company at $65 per share on the basis of one share for each twenty shares of common or 8 per cent preferred stock held. The subscriptions are payable in full on March 30. The directors have authorized the issuance of not less than 260,330 shares of common shares, which will take care of this offering.

U. G. I. on 9 per Cent Dividend Basis

The regular dividend rate on the capital stock of the United Gas Improvement Company has been increased from 8 per cent, or $4 per share per annum, to 9 per cent, or $4.50 per share per annum. At a meeting of the board of directors held January 23 a regular quarterly dividend of 2¼ per cent, or $1.12½ per share, was declared on the capital stock, payable March 30, 1929, to stockholders of record at the close of business February 28, 1929. In 1928 the company paid its regular dividend of 8 per cent plus an extra dividend of 1 per cent.

General Realty & Utilities Corporation Launched by Banking Group

UNDER the name of General Realty & Utilities Corporation, a $42,000,000 enterprise was launched this week by a banking group to conduct realty operations on a country-wide basis. Behind the new corporation are well-known construction and real estate interests. The ELECTRICAL WORLD is advised by a director of the new concern that it has no significance in the utility field except that it will probably invest in public utility securities.

Through an exchange of shares the new enterprise will be affiliated with the Thompson-Starrett Company, Inc., as well as with the Tishman Realty & Construction Company and other realty concerns. The president of the new corporation is Louis W. Abrons, a New York realty man, and among the directors are officers of the Allied Power & Light Corporation, Central States Electric Corporation and National Electric Power Company.

While details of the corporation's immediate operations have not yet been announced, it is expected to concentrate its realty operations in the New York area at first, later expanding throughout the country, especially in the field of construction and financing.

The authorized capitalization of General Realty & Utilities Corporation comprises 600,000 shares of no-par preferred stock and 5,000,000 shares of no-par common. A substantial amount of the new common stock will be bought for cash by the bankers and their associates, and a part of the preferred stock will be offered publicly in the near future, with common stock purchase warrants attached, it is stated. The proceeds will amount to more than $42,000,000, apart from the stock of the Thompson-Starrett Company, Inc., which will be acquired.

The board of directors will include Louis J. Horowitz, chairman of the board of the Thompson-Starrett Company; David Tishman, president, and Louis Tishman, vice-president, respectively, of the Tishman Realty & Construction Company; Herbert C. Freeman, director of the Central States Electric Corporation; Ray P. Stevens, president of the Allied Power & Light Corporation; Robert Lehman of Lehman Brothers; Maurice Newton of Hallgarten & Company; Charles Hayden of Hayden, Stone & Company; John W. Hanes, Jr., of Charles D. Barney & Company; George O. Muhlfeld, vice-president of Stone & Webster, and Samuel L. Fuller of Kissel, Kinnicutt & Company.

Westinghouse Reports Earnings to Exchange

The statement of the Westinghouse Electric & Manufacturing Company and proprietary companies, filed with the New York Stock Exchange for eight months ended November 30, 1928, shows net income of $15,295,926 after depreciation, taxes, interest, etc., equivalent to $6.45 a share (par $50) earned on 2,370,063 shares of combined preferred and common stocks, the two issues sharing alike in dividends, after 7 per cent has been paid on common.

The consolidated income account of the Westinghouse Electric & Manufac-

turing Company and proprietary companies for eight months ended November 30, 1928, follows: Sales billed, $124,098,142; cost, expenses, depreciation and taxes, $110,560,486; balance, $13,537,656; other income, $2,763,172; total income, $16,300,828; interest, $1,004,902; net income, $15,295,926.

Group Policy Insurance for Utility Companies

Frank D. Comerford, president of the New England Power Association, has announced that more than 1,500 employees of the company are participating in a group insurance program that involves about $3,000,000 of life insurance, $3,000,000 of accident, death and dismemberment protection and health, and non-occupational accident benefits. The plan, which will be on a co-operative basis, will be underwritten by the Metropolitan Life Insurance Company.

California Stockholders to Subscribe to Stock

Original preferred and common stock holders of the Southern California Edison Company will be given the right to subscribe to additional common stock at $25 per share on the basis of one share for every ten shares owned of record March 29. This offering is announced subject to the approval of the California Railroad Commission of the company's petition to offer 256,000 shares of $25 par value at not less than par. Funds derived from the sale of new stock will be used to reimburse the treasury for capital expenditures.

Pacific Gas & Electric Offers Rights

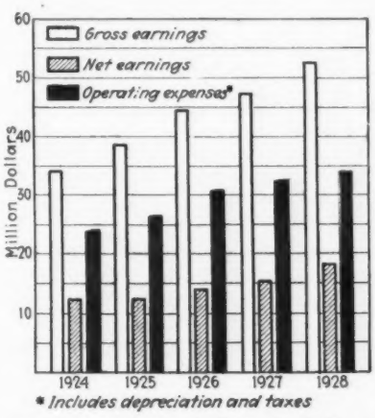
The Pacific Gas & Electric Company is giving its common-stock holders the right to acquire additional common shares of $25 par value in the ratio of one new share for each ten shares outstanding on February 8, 1929. Rights will expire on March 20. The company has arranged to permit payment for the stock to be made either in full at the time of the subscription or in four installments. The final date of payment for the last installment is fixed as June 20.

Cleveland Electric Votes Recapitalization Plan

Stockholders of the Cleveland Electric Illuminating Company have approved the plan of recapitalization recommended by the directors last month, providing for an increase in the authorized common stock to 3,000,000 no-par shares from 192,000 shares, having a par value of $100, and an exchange of the 166,298 outstanding common shares for 1,662,980 new common shares, and of the present 8,000 shares of 6 per cent preferred stock to 40,000 new common.

Detroit Edison Company Issues Annual Report

THE first annual report covering operations for the year 1928 was issued by the Detroit Edison Company last week. It was presented in the form customary in recent years—text preceded by consolidated income account and followed by a consolidated balance sheet. Gross earnings from all operations amounted to $52,366,335, as compared with $47,379,779 in 1927, and to these totals electric operations contributed $49,383,439 in 1928 and $44,759,413 during the preceding year. Net earnings from all operations, after operating expenses, depreciation and taxes were deducted, totaled $18,264,814, as compared with $15,223,804 in 1927. In commenting on the business of the year the report said: "With but few exceptions, the conditions which affected our business during 1928 were favorable and the exceptions were not of such magnitude as to change the results. The principal industries in our territory were very busy. Many makers of automobiles employed two or three shifts of men in some of their departments and for several months. This increased the call upon our circuit for electric power without requiring an increase in our generating plant. The low 'follow-on' price paid us for such overtime power carries a margin of profit above the increase in operating cost, and under the exceptional conditions of 1928 that margin showed in the year's net earnings. Filling up and adding to the working service in the slack period brought about the re-occupation of many small houses and apartments which had been vacant as we cited in our 1927 report. We estimate the population in our franchise area has increased from 2,100,000 at the end of 1927 to 2,190,000 at the end of 1928."

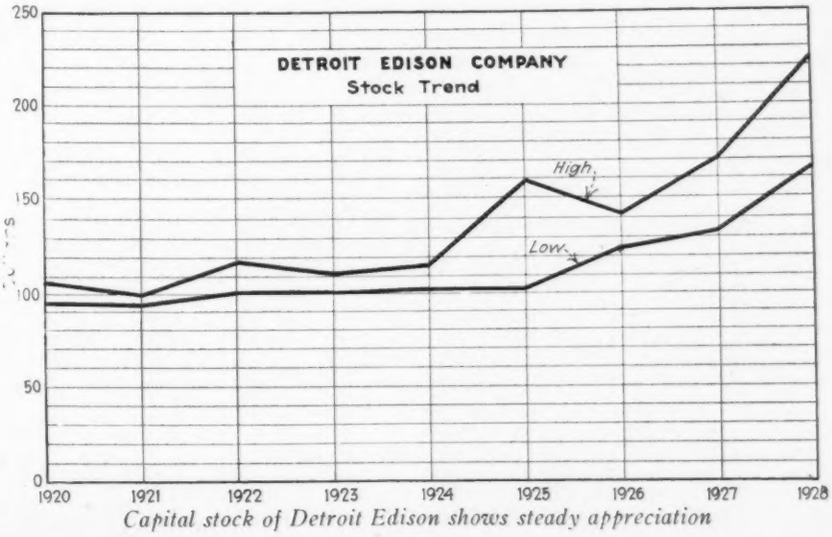


Gross earnings of Detroit Edison since 1924

The operating ratio dropped from 55.3 per cent in 1927 to 52.6 per cent in 1928. Average wages paid were higher and taxes were higher, but fuel costs were a trifle lower. In passing it is interesting to note that nearly 10 cents out of every dollar which was collected from customers was paid over as taxes to some governmental agency. Maintenance expenditures during the year were $3,017,398, as against $2,807,399 in 1927.

The capital stock of the company, currently quoted at around $234, has shown steady appreciation over a period of years. The high and low prices for the past three years were: 1926, 141-123; 1927, 170-133; 1928, 224-166. Earnings for these years were $11.32, $11.32 and $12.24. The current price of $234 is thus around nineteen times last year's earnings.

Output from the several power plants showed an increase of 13.8 per cent—from 2,142,549,100 kw.-hr. in 1927 to 2,438,304,900 kw.-hr. in 1928. Energy sold increased 14.7 per cent—from 1,811,100,684 in 1927 to 2,077,925,000 in 1928. Almost 99 per cent of the output was produced by the four big steam power plants, and the remainder by water power or it was purchased. Electric meters in service had a large increase, the net gain being 37,193. The



Capital stock of Detroit Edison shows steady appreciation

New Security Issues of Electric Service Companies in January

Name of Company	Amount of Issue (Par Value)	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
American European Securities Co.....	1,980,000	..	Cumulative preferred stock.....	To provide funds for the acquisition of additional securities and for other corporate purposes.....	6	99	6.06
Public Service Subsidiary Corp.....	6,000,000	20	Gold debentures, series A.....	To liquidate certain indebtedness and to supply capital for additional investments.....	5½	97	5.75
International Superpower Corp.....	2,575,000	..	Capital stock.....	To invest in utility securities.....	..	51½	....
Insull Utility Investments, Inc.....	6,000,000	20	Gold debentures, series A.....	To acquire capital stock of Insull, Son & Co., Inc., and other securities.....	5	100	5
	6,000,000	..	Prior preferred stock.....	.....	5½	100	5.50
Electric Investors, Inc.....	2,475,000	..	Preferred stock.....	To provide funds for the acquisition of additional interests in electric light and power companies and for other corporate purposes.....	6	99	6.06
Milwaukee Elec. Railway & Light Co..	10,000,000	32	Refunding and first mortgage gold bonds, series B.....	To provide funds to reinburse treasury for expenditures for property additions....	5	100½	5
Atlantic Gas & Electric Corp.....	1,000,000	14	First lien collateral trust gold bonds, series A.....	To reimburse in part for the acquisition of securities of certain subsidiary companies and for other corporate purposes	6	99	6.10
Associated Gas & Electric Co.....	25,000,000	20	Convertible gold debentures.....	Acquisition and retirement of securities...	4½	95	4.90
Penn-Ohio Edison Co.....	8,000,000	30	Gold debentures, series B.....	To reimburse company for cost of acquiring certain electric properties for construction expenditures and for other corporate purposes.....	5½	96½	5.75
Intercontinents Power Co.....	1,485,000	..	Cumulative preferred stock, first series.....	.....	7	99	7.07
American Electric Power Corp.....	1,200,000	29	Convertible gold debentures, series A.....	General corporate purposes.....	6	98½	6.10
Kentucky Utilities Co.....	8,150,000	40	First mortgage gold bonds, series I	To acquire new properties.....	5	99	5.05
Total.....	$79,865,000 (par value)			Rights.....	71,579,805		
Total amounts actually realized.....	78,011,100			Total financing for January.....	$149,590,905		

total number of electric meters in service on December 31, 1928, was 550,072. Although marked progress was made in the development of rural service in 1928, that field contains the only considerable group of possible customers which are not yet served. During 1928 there were built approximately 400 miles of branch lines for farm service and 2,200 new customers classified by the U. S. Census Bureau as "farmers" were connected. At the close of the year there were connected 7,707 farms out of a possible 22,000.

There were no unusual items of expenditure in plant investment account, which was increased by $24,210,975. During the year expenditures on new substations totaled $4,299,300 and on underground conduits and cables $4,958,400, exceptionally high sums. This condition will probably prevail for two or three years because the program calls for several new switching stations and industrial district substations, and for the underground connections from the power houses to these stations and for the outgoing cables to deliver the current to the distribution system.

Assets at Close of Year

Total assets at the close of 1928 amounted to $259,238,348, as compared with $234,249,911 at the end of 1927. Fixed capital was $229,688,868, against $205,477,894, and reserves were $22,174,010, against $17,878,556. In closing the report Alex Dow, president, said: "As to 1929, we expect that the first six months will be satisfactory, without being extraordinary. This expectation takes account of the reductions of our own selling prices; of the possibilities of some increases in operating costs, and of the probability that our local industries and the industries of the country at large will seek stabilization of recent gains."

Utility Issues Legal for Savings Banks Listed

The annual revised list of securities considered legal investments for savings banks in the State of New York was made public January 28 by Frank H. Warder, State Superintendent of Banks. Among the electric light and power securities were those listed below:

Alabama Power: first 5s, 1946; first lien and ref. 5s, 1951 and 1956; first refunding 4½s, 1967.
Binghamton Lt., Heat & Pwr.: first ref. 5s, 1946.
Blackstone Valley Gas & Elec.: first gen. 5s, 1939.
Brooklyn Edison: gen. 5s, 6s, 1930, 1949, series A, B; Kings County Elec. Lt. & Pwr.: first 6s, 1997.
Buffalo General Elec.: first 5s, 1939; first ref. 5s, 1939; gen. and ref. 5s, 1956.
Central Hudson Gas & Elec.: first and ref. 5s, 1957.
Central Maine Power: first 5s, 1939; first and gen. 4½s, 5s, 5½s, 1949-1957, series C to E.
Cleveland Elec. Illg.: first 5s, 1939; gen. 5s, 1954, 1961, series A, B.
Connecticut Lt. & Pwr.: first ref. 4½s, 5½s, 7s, 1951-1956, series A to C; New Milford Power: first 5s, 1932.
Connecticut Power: first and cons. 5s, 1963.
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore: ref. 5s, 5½s, 6s, 1949-1965, series A, E, F; gen. 4½s, 1935.
Consumers Power: first and ref. 5s, 1936; first and unif. 5s, 1952; Mich. Light: first ref. 5s, 1946.
Detroit Edison: first 5s, 1933; first and ref. 5s, 6s, 1940, series A, B; gen. and ref. 5s, 1949-1962, series A, B, C; Eastern Mich. Edison: first 5s, 1931.
Duke Power: first and ref. 4½s, 1967.
Duquesne Light: first 4½s, 1967.
Eastern Conn. Pwr.: first 5s, 1948, series A.
Empire Dist. Elec.: first ref. 5s, 1952; Ozark Pwr. & Water first 5s, 1952.
Erie County Elec.: Cons. 6s, 1959; gen. ref. 5½s, 1960.
Harrisburg Lt. & Pwr.: first and ref. 5s, 1952.
Idaho Power: first 5s, 1947.
Indiana & Mich. Elec.: first 5s, 1957; first and ref. 5s, 1955.
Kansas City Pwr. & Lt.: first 4½s, 5s, 1952, 1957, series A, B.
Kings County Ltg.: first ref. 5s, 6½s, 1954.
Metropolitan Edison: first and ref. 5s, 1953; first 4½s, 1968; York Haven Wtr. & Pwr.: first 5s, 1951.
Nebraska Power: first 5s, 6s, 1949.
New Jersey Pwr. & Lt.: first 5s, 1956.
New York Edison: first ref. 5s, 6½s, 1941, 1944, series A, B.
New York & Queens Elec. Lt. & Pwr.: first 5s, 1930.
Niagara Falls Power: first 5s, 1932; ref. and gen. 6s, 1932; first and cons. 6s, 1950; Hydraulic Pwr. of N. F.: first and refunding 5s, 1950; Hydraulic Pwr. of N. F.: ref. and imp. 5s, 1951.
Northern Indiana Pub. Serv.: first and ref. 5s, 5½s, 1960, 1966; Indiana Ltg. first 4s, 1958; Nor. Ind. Gas & Elec. first and ref. 6s, 1952; Nor. Ind. Gas & Elec. first 5s, 1929.
Pacific Gas & Elec.: gen. and ref. 5s, 1942; first and ref. 4½s, 5s, 5½s, 6s, 1941 to 1957, series B to E.
Pacific Pwr. & Lt.: first and ref. 5s, 1930.
Philadelphia Elec.: first sinking fund 4s, 5s, 1966; first and ref. 5½, 1947; first and ref. 5½s, 1953; first and ref. 5s, 1960; first and ref. 4½s, 1967.
Philadelphia Suburban-Counties Gas & Elec.: first ref. 4½s, 1957.
Public Service Elec. & Gas: first and ref. 4½s, 5s, 1965, 1967.
Queensborough Gas & Elec.: gen. 5s, 1952; ref. 5s, 1955.
Rochester Gas & Elec.: gen. 4½s, 5½s, 7s, 1946-1977, series B, C, D; Rochester Ry. & Lt.: cons. 5s, 1954.
Rockland Lt. & Pwr.: first ref. 4½s, 1958, series A.
San Diego Consol. Gas & Elec.: first 5s, 1939; first ref. 5s, 6s, 1939, 1947, series A, B, C.
Southern California Edison: gen. 5s, 1939; gen. and ref. 5s, 1944; ref. 5s, 1951, 1952; Pacific Lt. & Pwr.: first 5s, 1942; Pacific Light & Power: first ref. 5s, 1951.
Syracuse Ltg.: first 5s, 1951; first ref. 5½s, 1954.
Twin State Gas & Elec.: first ref. 5s, 1953; first ref. 5½s, 1945, Series A.
Union Elec. Lt. & Pwr. (Mo.): first 5s, 1932; ref. and ext. 5s, 1933; gen. 5s, 1954, 1967, series A, B.
Utica Gas & Elec.: gen. 5s, 5½s, 1949, 1956, series C, D; ref. and ext. 5s, 1957.
West Penn Pwr.: first 5s, 1946 to 1963, series A, E, F, G.
Wisconsin Gas & Elec.: first 5s, 1952.

Packard Electric to Split Stock.—At a special meeting of the stockholders a plan was adopted to increase the present 47,000 no-par common shares to 200,000 no-par shares and to give three shares of new stock for each share now held. The increased stock will be placed on a dividend basis of $2.50 per share per annum, at the rate of $7.50 per share on the present stock, which received $6 per share in 1928.

Business News and Market Conditions

Expanding Market for Electric Signs

The surface of the market for electric signs has just been scratched, John F. Gilchrist, vice-president of the Commonwealth Edison Company of Chicago, told a group of central-station men, salesmen and manufacturers' representatives who attended the course in electrical advertising given by the Great Lakes Division of the National Electric Light Association at Chicago last week. Mr. Gilchrist intimated that the potential market for the sale of electric advertising is $200,000,000.

Sponsored by the association for the purpose of educating the commercial and lighting departments of the various utility and electric sign companies in the best methods of promoting sales, the program was arranged to cover the entire field of the electric advertising business from designing and manufacture through to distribution and maintenance. It was brought out that the nation's annual advertising bill was approximately $1,300,000,000 and that of this amount the electric advertising business gets only about 5 per cent.

Among the speakers were Marshall E. Sampsell, president Central Illinois Public Service Company; James M. Gilchrist, Federal Electric Company; A. P. Good, Commonwealth Edison Company; O. D. Ziegler, Reynolds Electric Company; J. C. Wilms, General Electric Company; W. H. Rademacher, Edison Lamp Works; W. C. Brown, National Lamp Works; H. A. Cook, Detroit Edison Company; N. L. Whiting, Consumers Power Company; W. C. Downing, Sangamo Electric Company; W. A. Oglesby, Westinghouse Lamp Company; H. N. Wood, Penn-Ohio Power & Light Company.

Electrification Increases Demand for Copper

Copper annually consumed by two major forms of transportation, automobiles and railroads, now reaches the large total of 340,000,000 lb., according to surveys just completed by the Copper and Brass Research Association. Estimates of the association indicate a total of approximately 1,786,000,000 lb. of copper now in use in passenger cars of American manufacture and in the railroad systems of the nation today.

About 250,000,000 lb. of copper is consumed by the automobile industry every year, the association states. The small item of oil tubing in crankcases alone requires approximately 2,000,000 lb. of the metal annually.

In discussing the use of copper on railroads, the association estimates that between 75,000,000 and 100,000,000 lb. of the metal is consumed annually by this form of transportation. More than 850,000,000 lb. of copper and its alloys are now in use on American railroads, it declares, adding that "the increasing importance of electrification promises an even larger consumption of copper in the future."

Present electrification represents about 100,000,000 lb. of copper and covers only a small portion of existing track mileage. Electrification programs of the Pennsylvania and other roads are expected to add approximately 90,000,000 lb. of copper to these requirements.

Electricity for Coal Mining

British coal mines are using a steadily increasing quantity of electrical coal-cutting machines, as well as increased electrical equipment in general, according to the Department of Commerce. A report of the British electrical inspector of mines for the calendar year 1927, which has recently been issued, shows that only 1,797 electrically operated coal-cutting machines were in use in 1918, but that 3,478 were employed in 1927.

Financing New Plan Developed for Electrical Leagues

AN ORDERLY procedure for collecting and disbursing funds contributed by national manufacturers of electrical apparatus, materials and supplies for the support of local electrical leagues has been prepared by the Committee on Electrical Leagues and approved by the board of governors of the National Electrical Manufacturers' Association.

In the past there has been no satisfactory arrangement by which manufacturers have contributed to electrical leagues. Contributions amount to about 10 per cent of the combined league budgets. In the case of many small and medium-sized manufacturers no contributions have been made because it was felt that too great a burden would be imposed by a worth-while donation to each league. The correct amount to contribute to each respective league was another difficulty.

Under the new plan national manufacturers will be asked to subscribe to a common fund for the support of local electrical leagues, said fund to be collected by a board of trustees nominated by the respective electrical manufacturers, trade associations and approved by the board of governors for the Society of Electrical Development. The amount contributed is to be based in so far as possible on a percentage of sales to insure an equitable distribution of the manufacturers' proportion to the operating costs of the leagues. The funds thus collected will be allocated by the board of trustees, augmented by representatives of the S.E.D. and the league council, to such leagues having

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

Division	December 1927	December 1928	Per Cent Increase or Decrease	Twelve Months 1927	Twelve Months 1928	Per Cent Increase or Decrease
New York	265	227	—14.3	3,620	3,374	—6.80
Middle and Southern Atlantic	137	143	+ 4.38	1,999	2,202	+10.2
New England	147	149	+ 1.36	1,863	1,591	—14.6
Pacific Coast	25	8	—68	220	139	—36.8
Central	807	580	—28.1	10,524	8,764	—16.7
Total	1,381	1,107	—19.8	18,226	16,070	—11.8

TOTAL AMOUNTS REPORTED

	December 1927	December 1928	Per Cent Increase or Decrease	Twelve Months 1927	Twelve Months 1928	Per Cent Increase or Decrease
New York	$47,676	$50,013	+4.9	$565,220	$506,169	—10.4
Middle and Southern Atlantic	12,850	19,839	+54.4	236,033	283,870	+20.3
New England	17,599	17,706	+0.6	221,296	199,400	—9.89
Pacific Coast	3,192	1,197	—62.5	26,532	19,029	—28.3
Central	116,145	81,471	—29.9	1,186,226	1,049,816	—11.5
Total	$197,462	$170,226	—13.8	$2,235,307	$2,058,284	— 7.9

AVERAGE AMOUNTS

	December 1927	December 1928	Twelve Months 1927	Twelve Months 1928
New York	$180	$220	$1,878	$1,837
Middle and Southern Atlantic	94	139	1,426	1,546
New England	119	118	1,425	1,508
Pacific Coast	128	149	1,717	1,484
Central	144	140	1,356	1,439

individual membership dues of nominal amounts for representatives of contributing national manufacturers in proportion to the size and activity of the respective leagues.

A committee of eleven men appointed by the president of N.E.M.A. will serve as members of the board of trustees. The committee is composed of C. W. Abbott, D. R. Bullen, Marcus A. Curran, George E. Maguire, H. D. McKinney, S. L. Nicholson, H. C. Pond, R. J. Russell, A. L. Smith, A. E. Tregenza and E. A. Williford.

Industrial Truck Association

Announcement is made of the formation on January 1 of the Industrial Truck Association, composed of manufacturers of electric industrial trucks, tractors, storage batteries and accessory equipment. The association is a development of the co-operative sales and promotion activity which these manufacturers have conducted for the past three years through the Society for Electrical Development. The association's headquarters are located at 52 Vanderbilt Avenue, New York City. C. B. Crockett has been retained as secretary in charge of staff operations.

Supported by initial membership from fourteen companies producing more than 90 per cent of the products of the industry, the Industrial Truck Association, organized in the interest of co-operative sales promotion, has for its purpose the broadening of present markets, education of the public and the solution of materials-handling problems by the use of mechanical equipment.

N.E.M.A. Has High-Voltage Insulator Section

A high-voltage insulator section has been formed in the National Electrical Manufacturers' Association following a recent organization meeting at association headquarters which was attended by representatives of interested insulator companies.

The charter membership of the new high-voltage insulator section, under the chairmanship of J. S. Lapp of the Lapp Insulator Company, Inc., includes the following: Lapp Insulator Company, Inc., Leroy, N. Y.; Ohio Brass Company, Mansfield, Ohio; R. Thomas & Sons, East Liverpool, Ohio; Locke Insulator Corporation, Baltimore, Md.; Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Value and Destination of Electrical Exports for November

(Issued by Bureau of Foreign and Domestic Commerce)

Article	November 1927	November 1928
Generators:		
Direct current—		
Under 500 kw	85,875	135,121
500 kw. and over	243,951	48,764
Alternating current—		
Under 2,000 kva	6,658	14,503
2,000 kva. and over	277,602	23,196
Steam turbine-generator sets	109,112	50,419
Accessories and parts for generators	130,945	98,586
Self-contained lighting outfits	96,035	131,469
Batteries:		
Flashlight batteries	222,573	333,267
Other dry and wet cell primary batteries	187,422	197,749
Storage batteries	317,141	275,905
Transforming or converting apparatus:		
Power transformers	198,959	.....
Power transformers, 500 kva. and over	.....	86,052
Distribution transformers, less than 500 kva	.....	71,429
Other transformers	76,791	.....
Instrument transformers	.....	8,180
Other transformers, n.e.s.	.....	118,876
Battery chargers under 15 amp	.....	27,461
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	158,363	97,842
Transmission and distribution apparatus:		
Switchboard panels, except telephone	230,396	110,883
Switches and circuit breakers over 10 amp	278,682	147,659
Fuses and fuse blocks	37,649	40,772
Watt-hour and other measuring meters	17,049	117,310
Volt, watt and ampere meters and other recording, indicating and testing apparatus	260,676	.....
Electrical indicating instruments	.....	42,486
Electrical recording instruments	.....	16,099
Other electrical testing apparatus	.....	89,347
Lightning arresters, choke coils, reactors and other protective devices	104,622	56,303
Motors, starters, and controllers:		
Motors, under 1 hp	220,140	.....
Motors, ¼ hp. and under	.....	195,406
Motors over ¼ and under 1 hp	.....	55,731
Stationary motors—		
1 to 200 hp	313,671	449,544
Over 200 hp	72,278	32,594
Railway motors	68,753	18,355
Electric locomotives—		
Railway	.....	53,182
Mining and industrial	128,794	26,065
Station and warehouse electric motor trucks	5,918	1,775
Starting and controlling equipment—		
For industrial motors	115,133	129,443
For electric railway and vehicle motors	45,641	15,810
Portable electric tools	137,448	93,289
Accessories and parts for motors	200,835	247,820
Electric appliances:		
Electric fans	43,940	84,653
Electric lamps—		
Metal filament	122,197	134,075
Other electric lamps	47,618	84,194
Flashlights	226,682	194,241
Searchlights and projectors	34,979	53,733
Motor-driven household devices	195,235	.....
Electric vacuum cleaners	.....	135,321
Other motor-driven devices, except tools	.....	56,047
Domestic heating and cooking devices	136,989	.....
Electric flatirons	.....	42,927
Electric cooking ranges	.....	40,420
Other domestic heating and cooking devices	.....	110,027
Industrial electric furnaces and ovens	139,459	20,820
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	135,590	171,997
Signal and communication devices:		
Radio apparatus—		
Transmitting sets and parts	14,277	76,207
Receiving sets	577,398	753,856
Tubes	72,207	86,291
Receiving-set components	255,112	363,720
Receiving-set accessories	340,770	349,377
Telegraph apparatus	56,895	96,309
Telephone apparatus—		
Telephone instruments	27,263	53,493
Telephone switchboards	10,014	22,323
Other telephone equipment	173,335	198,911
Railway signals, switches, and attachments	52,087	54,778
Bells, buzzers, annunciators and alarms	23,016	31,208
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	128,694	.....
Spark plugs	.....	175,182
Other starting, lighting, and ignition equipment	.....	49,826
Insulating material	129,930	110,149
Metal conduit, outlet and switch boxes	81,058	111,397
Sockets, receptacles, and lighting switches	157,334	170,941
Electric lighting fixtures, interior and street	215,889	.....
Electric interior lighting fixtures	.....	218,074
Electric street lighting fixtures	.....	106,049
Other wiring supplies and line material	84,200	73,355
Other electrical apparatus, not elsewhere specified	615,037	811,641
Rubber and friction tape	40,325	40,851
Globes and shades for lighting fixtures	60,855	61,109
Electrical glassware except for lighting	26,291	39,743
Electrical porcelain:		
For less than 6,600 volts	55,729	56,746
For 6,600 volts and over	38,416	78,569
Carfons, carbon brushes and electrodes:		
Electrodes for electric furnaces	151,181	163,423
Other carbon brushes	107,485	70,29
Insulated wire and cable, iron or steel	10,276	29,216
Copper, bare wire	200,453	240,240
Copper, insulated wire and cable	440,245	405,069
Refrigeration sets up to 1 ton capacity	328,067	799,872
Domestic washing machines	156,564	166,441
Totals	$10,062,204	$10,851,811

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	November, 1928 Value
EUROPE:	$1,735,799
Belgium	89,403
France	168,100
Germany	121,690
Italy	174,035
Netherlands	106,012
Spain	163,598
Sweden	26,563
United Kingdom	639,359
Other countries	247,039
WESTERN HEMISPHERE:	$6,787,059
Canada	3,364,612
Mexico	507,457
Cuba	424,113
Argentina	799,549
Brazil	510,035
Chile	164,629
Colombia	244,221
Peru	44,346
Venezuela	128,722
Other countries	599,375
ASIA, AFRICA AND OCEANIA:	$2,328,953
British India	130,030
China	328,900
Japan	211,221
Philippine Islands	185,057
Australia	772,801
New Zealand	84,238
Union of South Africa	240,588
Other countries	376,118

Market Conditions

ACCELERATING industrial activity in the leading industrial areas of the country is reflected in plant extension and equipment buying on a large scale. This type of business has for the moment supplanted central-station business.

In the Southeast the volume of electrical equipment business arising from power companies is rather lower than was anticipated a month ago. This, however, is made up for by expanding industrial demand.

Manufacturing industries in many parts of the Eastern district are adding to plant capacity and equipment; inquiries are numerous and orders in some cases have accumulated. Orders for transformers and other central-station equipment are about average.

In New England power company business is active, but industrial business heads the list.

The Middle West reports the same speeding up of industrial activities that is noted in other sections. Several large plant additions are reported. In the St. Louis district the total volume of equipment business is stated to be 25 per cent larger than that of January last year.

On the Pacific slope the railroads are carrying out an active construction program and telephone construction reaches a substantial total in mileage. In the Puget Sound area buying is somewhat quieter than is usual.

Optimistic Feeling Noticeable in Southeast

Activities of the new year seem to be somewhat slow in getting under way in the Southeast, but there is a feeling of optimism in the trade regarding the outlook. Orders and inquiries in both central station and industrial lines are reasonably satisfactory, with the latter leading in the orders that were placed. A new tire fabric mill in Alabama ordered 80,000 hp. in motors, while a rice mill in Louisiana placed an order for similar equipment to the extent of $15,000. A Georgia contractor ordered wiring materials aggregating $1,000 to go into a cotton mill job in Tennessee and a Georgia clay mining company ordered 150 hp. in motor equipment. Three 50-kw. transformers will be ordered in connection with the Clay Products Company job. One of the larger central stations ordered 45,000 lb. of weatherproof copper wire and distribution and small power transformer equipment totaling $3,100. A West Georgia town ordered traffic signal equipment and pole line materials amounting to $4,500, while another town in the same state ordered pole line materials totaling $2,000. Another municipality placed two orders for wire and transformers aggregating $3,000. A contract will be let on a "white-way" installation in a north Georgia town to cost $10,000. There is a very satisfactory amount of "white-way" lighting business pending which should be closed in the near future and another job pending is the lighting of the Saint Simons Island causeway, involving 82 posts and the electrifying of the swinging bridge on this causeway. Construction projects are as follows:

The Winchester Cold Storage Company, Winchester, Va., plans a cold storage refrigerating plant to cost $150,000. The Appalachian Electric Power Company, Bluefield, W. Va., plans extensions in transmission lines near Tazewell, Va. The Virginia Public Service Company, Charlottesville, Va., plans a hydro-electric plant on the North River, to cost $450,000. The Volunteer Portland Cement Company, Knoxville, Tenn., plans additions to its mill to cost $550,000. The Kentucky-Tennessee Light & Power Company, Bowling Green, Ky., plans extensions in its ice plant at Martin, Tenn., to cost $60,000. Maryville, Tenn., plans extensions in its light and power system to cost $200,000. The Holston River Power Company, Kingsport, Tenn., plans a hydro-electric development on the Holston River, to cost $700,000, with transmission system.

Industrial Equipment Orders Increase in New England

Orders for industrial equipment are increasing in the New England district. Inquiries for a wide range of equipment are gaining in volume. Motors for group and individual drive are in demand with control apparatus active and central-station equipment buying is encouraging. Several interesting orders for power equipment were recorded. One order for large power motors amounting to $40,000, including control equipment, is noted and several orders for motors for individual drive amounting to $11,000 were reported. Loom motors are receiving some attention and pumping units are active. This month orders for this type of equipment have reached an encouraging volume and are heavier than for the corresponding time last year. Switch and control apparatus is selling well, while orders will soon be closed for several power plant generating units. Specifications are receiving attention for wheels and generators for a prominent northern Maine hydro-electric project.

Central-station equipment is active and recently orders amounting to $10,000 were received for substation equipment to be used in Maine. Insulators are in steady demand and inquiries for transformers are gaining. Industrial electric heating furnaces are being considered for a plant addition in eastern Massachusetts. Ornamental electric lighting for galleries and schools has received attention and a number of installations have been recently concluded. Harvard University, Cambridge, Mass., plans a heating plant.

Improved Industrial Demand in Eastern District

Industrial account shows increasing strength in the Eastern district and, based on current inquiries, there is an accumulation of orders for equipment of such kind that will amount to more than the average business for this time of the year. Motor-generator sets, motors, transformers and affiliated apparatus are in demand. A maker of ball bearings in Connecticut has contracted with an Eastern manufacturer for three motor-generator sets to cost $20,000. A cement mill in Michigan has purchased a 900-hp. direct-current motor drive from a New Jersey maker, costing $12,000, while another such mill in northern New York has placed an order for transformers and affiliated equipment to a total of $30,000.

Central-station call holds up well for general equipment, with inquiries indicating continuance of buying for several weeks to come. A power company in northern New York has given an order to a state manufacturer for transformers, switchgear and miscellaneous affiliated apparatus to cost $60,000. A Western central station has awarded a contract for transformers and auxiliary equipment to a total of $95,000. The Bureau of Indian Affairs, Washington, has placed an order with the Westinghouse Electric & Manufacturing Company for power station equipment at the Coolidge Dam and transmission line apparatus to the amount of $180,000.

Cable account shows a marked revival. Power companies are entering the market and there are a number of large projects pending. A metropolitan power company has placed a commitment for paper wound cable to an amount of $40,000. Business in fuses is quiet with a lagging call both for plug and cartridge types. Electric elevator demand is fair, with forthcoming early sales anticipated to reach a substantial total. Floodlighting equipment continues to be an active market factor, for airport service and for office buildings and public structures. Construction projects are as follows:

The Rochester Gas & Electric Company, Rochester, N. Y., contemplates a steam-turbo generating station, to cost $1,000,000. The Careful Carpet Cleaning Company, New York, will build a plant at Long Island City, to cost $200,000. The Board of Education, New York, plans a trade school for girls at Brooklyn, to cost $1,035,000. The Gordon Baking Company, De-

troit, plans a branch plant at Long Island City, to cost $100,000. The Niagara, Lockport & Ontario Power Corporation, Buffalo, N. Y., will build a transmission line to Holley. The Zenitherm Company, Newark, N. J., will build an addition to its factory to cost $200,000. The Public Service Electric & Gas Company, Newark, N. J., plans extensions in power substations, transmission lines and distributing system, to cost $10,000,000. The Smooth-On Manufacturing Company, Jersey City, N. J., plans an addition to its factory, to cost $60,000. The New York Telephone Company, New York, will make extensions and improvements in its equipment storage and distributing plant to cost $85,000.

Plans are being drawn by Christian Fries, Philadelphia architect for a hosiery mill to cost $85,000. The Willow Grove Hospital and Sanitarium, Willow Grove, Pa., plans institutional buildings and a power plant to cost $450,000. The Becker Seamless Tube Company, Columbia, Pa., will build a mill to cost $80,000. The Sunbury Industrial Building, Inc., Sunbury, Pa., plans a factory to cost $100,000. The Easton Hospital, Easton, Pa., plans institutional buildings and a power house to cost $500,000. A. M. Byers Company, Pittsburgh, plans five mills for wrought iron pipe manufacture at Ambridge, Pa., to cost $6,000,000. The Pittsburgh Plate Glass Company, Pittsburgh, will make extensions in plants, including paint and lacquer plants at Milwaukee, Wis., to cost $12,000,000.

Telephone Orders Feature Pacific Coast Business

Railroads plan many despatching circuits on the Pacific Coast, while power company business is active and prospects continue excellent. The Southern Pacific Company is beginning much new line construction, such as two physical telephone circuits between Klamath, Ore., and Alturas, Calif., totaling 420 miles; a telephone circuit between Sparks, Nev., and Westwood, Calif., a distance of 145 track-miles; a telephone circuit between Oakland and Santa Rosa, Calif., a distance of 110 track miles, and a multiplex printing system connecting El Paso and Los Angeles with a drop channel to Tucson, Ariz., necessitating three machines costing $7,500 each.

The Pacific Gas & Electric Company recently bought four carloads of bare copper wire and two carloads of pole line material and is in the market for its 1929 pole requirements, comprising 6,000 assorted sizes, principally 8-in., 35 and 40 ft., valued at $75,000. This company has announced a pole line extension to tap new south San Francisco industrial plants and a 26-mile line into the lumbering country south of Ukiah.

Industrial buying was extremely light in the Puget Sound district, the sales including a few motors for replacements of minor additions, while central stations bought only routine items involving small distribution transformers, meters, fuses, etc. One of the largest jobbers reported only a $5,000 week. The city of Seattle has opened bids for 125,000-lb. of weatherproof solid and stranded copper wire. Specifications for apparatus for the second 35,000-hp. unit of the Lake Cushman hydro-electric project for the city of Tacoma is expected to be given bidders within three weeks. The Pacific Power & Light Company will spend $100,000 in extensions. Construction projects are as follows:

The Signal Corps, General Depot, San Francisco, will receive bids until Feb. 18 for electrical supplies (Circular 54); and until Feb. 17 for strain insulators (Circular 60). Pasadena, Oakdale and Los Angeles, Calif., Walla Walla and Kent, Wash., and Butte, Mont., plan ornamental lighting systems. Lodi, Calif., plans a municipal light and power plant to cost $75,000. The Medford Ice & Storage Company, Medford, Ore., contemplates an ice-manufacturing and cold storage plant to cost $200,000. Clarkston, Wash., contemplates an improved street lighting system. Centralia, Wash., plans a bond issue of $1,000,000, for a municipal hydro-electric plant. The Montana Power Company, Great Falls, Mont., plans extensions and improvements in power plants, transmission lines, and power substations, to cost $700,000.

Industrial Sales Active in St. Louis District

Orders for industrial equipment are coming in stronger than ever in the St. Louis district. All lines of electrical merchandising for January are about 25 per cent better than last year. There are no very large contracts, but several are noted to be in process. A bank of transformers was sold to a manufacturing company for $11,000. A lead mining company bought four motor-driven centrifugal blowers costing $25,000 and a 1,000-kva. substation complete with a bank of transformers, steel work and outdoor switching equipment to cost about $10,000 was bought by a power company in the southern part of the district. Construction projects are as follows:

The Kansas Flour Mills Company, North Kansas City, Mo., plans an addition to its elevator to cost $150,000. The Hinde & Dauch Paper Company, Sandusky, Ohio, plans a mill at St. Louis, Mo., for the manufacture of corrugated board products, to cost $100,000. The Laclede Power & Light Company, St. Louis, plans a power substation to cost $30,000. The St. Joseph Structural Steel Company, St. Joseph, Mo., plans additions to its mills to cost $100,000. St. Joseph, Mo., plans an improved street lighting system. The Union Electric Light & Power Company, St. Louis, will make extensions and improvements in its power plants at Cahokia and Venice, Ill., to cost $2,000,000. The Oklahoma Structural Steel Company, Oklahoma City, Okla., plans a number of mill units to cost $500,000. The Pillsbury Flour Mills Company, Minneapolis, Minn., plans a grain elevator at Enid, Okla., to cost $250,000. The Chamber of Commerce, Helena, Ark., is at head of a project to construct and operate a local grain elevator to cost $100,000. LaPorte, Tex., plans an ornamental lighting system. The Houston Lighting & Power Company, Houston, Tex., plans addition to the Deepwater power plant to increase capacity by 50,000 kw., to cost $2,000,000, and will make extensions and improvements in transmission lines, substations and distributing system, to cost $3,000,000. The Acme Brick Company, Fort Worth, Tex., plans extensions in its plant to cost $200,000. The Maverick County Water Improvement District No. 1, Eagle Pass, Tex., plans hydro-electric project in connection with the irrigation development, the entire project to cost $1,800,000.

Industrial Activity Improves in Middle West

Business in the Middle West section continues to show improvement. Several notable additions to manufacturing plants were announced this week, that of the Western Electric Company, to cost $1,500,000; the Pines Winter Front Company, to cost $3,000,000, and the Victor Manufacturing & Gasket Company, to cost $425,000. The automotive industry is in excellent shape, with production scheduled at a high rate. The steel industry is operating on an entirely satisfactory basis, while the railroad demand for equipment is substantially larger. The utility companies are busy with a considerable amount of winter construction work and a large amount of rehabilitation work is now in progress. The demand for apparatus is somewhat light, although a large amount of distribution equipment is being purchased, among which are the following orders: Six 4,000-amp. and six 5,000-amp., 12,000-volt current-limiting reactors, sixty-six 600-amp., 15-kv. single-pole disconnecting switches, construction of substation building to cost $85,000, complete armature for 13,000-amp. booster converter to cost $22,000 and 150 impulse relays. Jobbers' sales are normal. There has been a good demand for motors, conduit, wire and wiring devices. Construction projects are as follows:

Stoughton, Wis., plans a municipal steam-operated electric power plant to cost $35,000. The Phoenix Chair Company, Sheboygan, Wis., has authorized the complete electrification of its mill to cost $35,000. The Kearney & Trecker Corporation, Milwaukee, Wis., plans an addition to its machine tool plant to cost $100,000. The United States Engineer Office, Detroit, will receive bids until Feb. 18 for one steam turbine generator unit, (Circular 3). The Packard Motor Car Company, Detroit, plans an addition to cost $250,000. The Cadillac Motor Car Company, Detroit, will soon take bids for an addition to cost $200,000. The East St. Louis Casting Company, East St. Louis, Ill., plans an addition to cost $115,000. The Mid-Continent Petroleum Corporation, Louisville, Ky., plans an oil storage and distributing plant at East St. Louis, Ill., to cost $100,000. Arlington Heights, Ill., plans an ornamental lighting system. The Cudahy Packing Company, Chicago, plans expansions and improvements and cold storage and refrigerating plants and packing houses in various localities, to cost $1,000,000.

NEW YORK METAL MARKET PRICES

	Jan. 23, 1929 Cents per Pound	Jan. 30, 1929 Cents per Pound
Copper, electrolytic	17	17
Lead, Am. S. & R. price	6.65	6.65
Antimony	9.50	9.50
Nickel, ingot	35	35
Zinc, spot	6.70	6.70
Tin, Straits	48.875	48.625
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Jan. 30, 1929, 18¾ cents.

Activities of the Trade

Anaconda's Output for 1928 Shows Increase

The production of the Anaconda Copper Mining Company and its subsidiaries in 1928 amounted to 272,238,773 lb. of copper, compared with 246,469,585 lb. in 1927; 316,570,924 lb. of zinc, against 237,514,767 lb. in 1927, and 174,672,128 lb. of lead, compared with 168,532,840 lb. in 1927.

Details of the formal offer made by the Anaconda Copper Mining Company for the minority stock of the Chile Copper Company are announced this week. The offer, which involves the issue of 73/100 of one share of $50 par value stock of Anaconda Copper Mining Company for each share of stock of Chile Copper Company, will expire April 30, next.

Pirelli Company Raises Capital Here

An offering of stock of the Pirelli Company of Italy is being made by the National City Company. The Pirelli Company of Italy, founded 57 years ago, is one of the largest producers and distributors of cable and wire for power, telephone, telegraph and submarine cable transmission in the world.

THE GENERAL REFRACTORIES COMPANY, 104 South Sixteenth Street, Philadelphia, has opened an office in San Francisco, at 742 Russ Building. W. E. Dornbach, formerly of the company's Philadelphia office, is in charge.

THE BOILER ENGINEERING COMPANY, 931 Federal Trust Building, Newark, N. J., manufacturer of the "Beco" boiler baffle wall, announces that John D. Hiles, Oliver Building, Pittsburgh, will handle the Pittsburgh territory and the Cleveland territory will in the future be handled by the Power Auxiliary Company, under the direction of H. F. Bauer, in Cleveland.

THE JOHN ROBERTSON COMPANY, INC., 121 Water Street, Brooklyn, N. Y., manufacturer of hydraulic presses and pumps, announces a new lead melting pot with a motor-driven lead pump. This melting pot is equipped with a motor-driven centrifugal pump having a capacity for pumping 2,000 to 2,500 lb. of lead per minute.

THE KELVINATOR SALES CORPORATION, Detroit, has purchased the Kelvinator-Philadelphia, Inc., 36 South Seventeenth Street. With its acquisition by the parent company, the Philadelphia distributing organization now becomes a factory unit. The operation of the business will be continued at the same address under the existing name. The Kelvinator-Philadelphia, Inc., will be under the direction of Campbell Wood, president and also the Kelvinator district sales manager; George W. Moister, vice-president and general manager, and G. E. Rogo, secretary and treasurer.

THE LOCKE INSULATOR CORPORATION, Baltimore, has been awarded the order for all insulators, grading shields and hardware for the 90-mile Roseland-Bushkill 220-kv. transmission line. The order also includes releasing clamps of a new design.

THE WESTINGHOUSE LAMP COMPANY, 150 Broadway, New York City, announces that Arthur J. Sweet, formerly in consulting practice in Milwaukee, Wis., has joined its commercial engineering department. The company will commence, under Mr. Sweet's direction, a broadened program of service to the industry, more especially to the central station, in the development of street-lighting business and business-building possibilities.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, announces a new ¼-in. light duty electric drill that will sell for $25.

New Equipment Available

Overload Relays with Renewable Heaters

A new line of double and triple pole temperature overload relays which allow the user to move and insert new heating elements when necessary and which also allow the use of the third relay unit on the same base when it is desired to protect three legs of the circuit is announced by the General Electric Company.

The new line is divided into two parts, bearing the designation T.C. 121 and T.C. 131. The former is designed for the protection of two legs of a circuit, while the latter provides an element for the protection of a third leg. Both forms are rated in current carrying capacity from 30 to 150 amp. and are available for either front or back connecting. The back-connected forms are for panel mounting, but use the same base as on the front connected forms. On inclosed panels air drafts are eliminated by the inclosing case, but on open panels it is necessary to use a cover over the relay.

An electric reset is provided as an accessory. When used with a relay which is mounted at the bottom of a base a sub-base is added. The sub-base is clamped to the main base by the relay itself. Where there is sufficient space the reset relay can be mounted on the panel itself.

Tumbler Switch for Single-Phase Motors

A small single-pole switch for controlling fractional-horsepower, single-phase motors is announced by the Trumbull Electric Manufacturing Company of Plainville, Conn. The box size of the surface type is 2⅛ in. wide by 4⅛ in. high by 3 in. deep and operation is the same as for the ordinary no-fuse switch.

Handle trips to "off" position on an overload. To reset it is simply necessary to throw the handle "on" after the thermostatic metal has cooled. One of the leading features is that the switch cannot be held "on" against an overload. Operating characteristics are similar to those of thermal overload relays or thermal plugs. There is no fusible element which requires replacement.

Safety Push Button

A safety type push button recently developed by the Lincoln Research Laboratories is now being marketed by the Lincoln Electric Company, Cleveland, Ohio. A ball top start button is contained inside a large stop button which projects over the start button. This is designed to increase the safety feature. The stop button protects the start button from accidental contact. The inner mechanism is inclosed in an arc-welded steel box. All insulated parts are of molded bakelite. The entire exterior is jet black with the exception of the push buttons, which are colored.

Strip Heaters with Double Function

An electric strip heater which may be applied either as an air heater or as a clamp-on device has been announced by the General Electric Company. The new equipment is designed for general purposes where electric heat is required and is suggested for use in cabs, valve houses, pump houses, telephone switchboards, process machines, drying ovens, compound tanks, warming tables, etc. It is 24 in. long, 1½ in. wide and ⅜ in. thick and is rated 500 watts at 100 or 220 volts.

Both terminals are at one end of the unit and project from the same side. The current-carrying resistance wire inside the sheath is the usual nickel-chromium resistor wound in a helix. The coil is supported at each end by a porcelain insulator and is stretched down the length of the unit four times, providing even distribution of heat over the entire surface of the unit. The resistor is insulated from the sheath by magnesium oxide powder.

Electrical Patents

Announced by U. S. Patent Office

(Issued January 8, 1929)

1,697,976. DISCONNECTING AND RECONNECTING DEVICE FOR DISTANT-CONTROL ARRANGEMENTS; E. Granat, Paris, France. App. filed Aug. 2, 1927.

1,697,979. ELECTRICALLY-OPERATED APPARATUS PROTECTOR; R. C. Keddy, West Somerville, Mass. App. filed Oct. 31, 1927.

1,697,980. SWITCH; C. R. Krone, Oakland, Calif. App. filed Aug. 23, 1926.

1,698,016. LIGHTING FIXTURE; E. F. Guth, St. Louis, Mo. App. filed Aug. 17, 1926.

1,698,037. ELECTRIC SWITCH; H. L. Van Valkenburg, Wauwatosa, Wis. App. filed March 28, 1927.

1,698,050. CABLE AND TRANSMITTING ELECTRICAL ENERGY; L. Emanueli, Milan, Italy. App. filed April 20, 1925.

1,698,051. JOINT FOR HIGH-TENSION ELECTRIC CABLES; L. Emanueli, Milan, Italy. App. filed Sept. 1, 1925.

1,698,080. WELDING APPARATUS; R. F. Agnew, Milford, Mich. App. filed Aug. 18, 1926.

1,698,095. HEATING UNIT; F. M. Hibben, Lakewood, Ohio. App. filed June 23, 1927.

1,698,146. BREAD TOASTER; C. P. Strite, Minneapolis, Minn. App. filed July 10, 1926.

1,698,184. HEATING ELEMENT FOR ELECTRIC FIRES OR RADIATORS; H. H. Berry, London, England. App. filed April 2, 1928.

1,698,200. APPARATUS FOR MEASURING PRESSURE OF PISTON RINGS; M. Okochi and K. Ebihara, Tokyo, Japan. App. filed Aug. 3, 1926.

1,698,231. MEANS FOR ALIGNING ELECTRICAL FIXTURES WITH FACEPLATES; H. Hubbell, Bridgeport, Conn. App. filed Jan. 3, 1927.

1,698,276. VOLT-AMPERE-INDICATING INSTRUMENT; W. H. Pratt, Lynn, Mass. App. filed Feb. 21, 1924.

1,698,282. ELECTRIC HEATER; A. H. Simmons, Wheaton, Ill. App. filed Nov. 28, 1925.

1,698,283. MECHANICAL RECTIFIER; C. P. Steinmetz, Schenectady, N. Y. App. filed Aug. 27, 1923.

1,698,284. ARRANGEMENT FOR OBTAINING LARGE OUTPUTS IN FREQUENCY CHANGERS; G. G. von Arco and M. Osnos, Berlin, Germany. App. filed Oct. 25, 1922.

1,698,288. MOTOR-CONTROL SYSTEM; H. A. Winne, Schenectady, N. Y. App. filed Jan. 5, 1927.

1,698,289. HEATING UNIT AND METHOD OF MAKING IT; C. C. Abbott, Pittsfield, Mass. App. filed Nov. 18, 1924.

1,698,291. CONTROL SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed July 31, 1924.

1,698,292. AUTOMATIC CONTROL SYSTEM; H. Bany, Yeadon, Pa. App. filed Oct. 3, 1927.

1,698,293. CONTROL FOR DYNAMO-ELECTRIC MACHINES; T. F. Barton, Schenectady, N. Y. App. filed Feb. 18, 1921.

1,698,295. CONTROL SYSTEM FOR ELECTRO-RESPONSIVE DEVICES; E. F. Bliss, Alplaus, N. Y. App. filed March 30, 1923.

1,698,305. TROUBLE DETECTOR FOR MESSENGER CALL CIRCUITS; G. W. Janson, Nutley, N. J. App. filed June 28, 1926.

1,698,315. CONTROL OF INDUCTION MOTORS; H. Maxwell, Schenectady, N. Y. App. filed Oct. 16, 1926.

1,698,316. DIFFERENTIAL FREQUENCY RELAY; G. R. McDonald, Schenectady, N. Y. App. filed May 6, 1925.

1,698,322. CENTRIFUGAL DEVICE; O. Stöbe, Berlin, Germany. App. filed Oct. 10, 1925.

1,698,325. REVERSING MOTOR-CONTROL SYSTEM; R. N. Thomas and G. H. Dorgeloh, East Orange, N. J. App. filed May 12, 1926.

1,698,337. ELECTRIC PROTECTIVE SYSTEM; B. H. Leeson, Tynemouth, and R. W. Biles, Balcombe, England. App. filed June 23, 1926.

1,698,358. MAXIMUM-LOAD ELECTRICITY METER; O. Borel, Geneva, Switzerland. App. filed Dec. 16, 1927.

1,698,379. ELECTRICAL CONNECTER; J. Taylor, Chicago, Ill. App. filed May 21, 1927.

1,698,389. MEANS FOR ELECTRIC-CURRENT DISTRIBUTION; G. R. Brown, Croydon, near Sydney, New South Wales. App. filed Aug. 31, 1926.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

1,698,418. LAMP HANGER; A. J. Thompson, Cleveland, Ohio. App. filed Feb. 23, 1923.

1,698,449. PLUG RECEPTACLES; C. M. Petersen, Trenton, N. J. App. filed March 27, 1928.

1,698,472. PROCESS OF MAKING METAL FOILS; J. R. Cain, Washington, D. C. App. filed May 3, 1926.

1,698,486. PROCESS OF MAKING METALLIC SHEETS BY ELECTROPLATING; G. Yungblut, Dayton, Ky. App. filed Sept. 19, 1927.

1,698,500. ELECTRIC MOTOR; J. J. Janca, St. Louis, Mo. App. filed March 31, 1927.

1,698,548. DELAYED SWITCH ACTION; P. P. Kaufman, Appleton, Wis. App. filed April 9, 1926.

1,698,556. ALTERNATING-CURRENT MOTOR; S. H. Mortensen, Milwaukee, Wis. App. filed June 10, 1922.

1,698,560. CONTROL SYSTEM; J. B. Price, Pittsburgh, Pa. App. filed Oct. 9, 1926.

1,698,581. AUTOMATIC REGULATION OF THE POWER FACTOR IN ELECTRIC FURNACES; D. F. Campbell and G. E. Taylor, London, England. App. filed Jan. 4, 1928.

1,698,587. SWITCH AND FUSE-PLUG SOCKET; F. P. Gates, West Hartford, Conn. App. filed Jan. 7, 1927.

1,698,596. ELECTRIC WATER HEATING; L. P. Hynes, Albany, N. Y. App. filed July 27, 1927.

1,698,629. TERMINAL CONNECTER; W. T. Haley and R. R. Williams, Christopher, Ill. App. filed May 15, 1926.

1,698,654. PACKING; W. Rautenstrauch, Palisade, N. J. App. filed Sept. 11, 1923.

1,698,691. HIGH-INTENSITY INDUCTION LAMP; L. J. Buttolph, Grantwood, N. J. App. filed July 1, 1926.

1,698,704. PORTABLE ELECTRIC CABLE; W. I. Middleton, Watertown, and C. R. Boggs, Waban, Mass. App. filed Jan. 10, 1925.

(Issued January 15, 1929)

1,698,707. FIXTURE SUPPORTING AND CONNECTING DEVICE; S. J. Aaron, Brooklyn, N. Y. App. filed July 23, 1926.

1,698,708. LIGHTING FIXTURE; A. B. Allworth, Meriden, Conn. App. filed June 26, 1925.

1,698,723. ELECTRIC SYSTEM; H. S. Holmes, New York, N. Y. App. filed Sept. 11, 1924.

1,698,770. SIGNALING CIRCUITS; R. S. Ohl, Little Silver, N. J. App. filed Dec. 1, 1927.

1,698,799. BRUSH-LIFTING MECHANISM FOR ELECTRIC MOTORS OR THE LIKE; G. H. Leland, Dayton, Ohio. App. filed July 13, 1927.

1,698,801. ELECTRIC WATER HEATER; A. Martin, Ogdensburg, N. Y. App. filed Nov. 20, 1924.

1,698,812. ELECTRIC SIGNALING CONTROLLED BY MECHANICAL VIBRATIONS; J. Gardner, Bolton-Le-Sands, Carnforth, England. App. filed March 17, 1920.

1,698,820. CURRENT TAP FOR INSTALLATION ON ELECTRIC-SUPPLY CORDS; G. J. Meuer, Milwaukee, Wis. App. filed March 5, 1921.

1,698,824. APPARATUS FOR HEAT TREATING METALLIC BODIES; E. Romanelli, Bloomfield, N. J. App. filed July 31, 1926.

1,698,845. METHOD OF DRY-COATING LAMP BULBS; D. S. Gustin, Bloomfield, N. J. App. filed Dec. 10, 1927.

1,698,857. SOUNDING ARRANGEMENT; G. Schmidt and B. Settegast, Kiel, Germany. App. filed May 18, 1923.

1,698,911. WATER HEATER; C. Hellsten, Brooklyn, N. Y. App. filed May 11, 1928.

1,698,917. CARBON CONTROL FOR ARC LAMPS; L. S. Kubiac, Youngstown, Ohio. App. filed Aug. 26, 1925.

1,698,918 and 1,698,919. ELECTRIC-ARC LAMP; L. S. Kubiac, Youngstown, Ohio. Apps. filed Nov. 26, 1927.

1,698,921. METHOD OF CONSTRUCTING METALLIC RECTIFIER PLATES; C. E. Ogden, Cincinnati, Ohio. App. filed Feb. 17, 1928.

1,698,930. TIME-CONTROLLED SAFETY DEVICE FOR SAFE LOCKS; E. R. Anderson, Moroni, Utah. App. filed July 25, 1927.

1,698,976. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; H. Weichsel, St. Louis, Mo. App. filed Nov. 2, 1925.

1,698,992. ELECTRIC WATER HEATER; M. S. Gazelle, Detroit, Mich. App. filed Feb. 3, 1926.

1,698,994. THEFT-PROTECTION DOOR FOR BUILDINGS; E. C. Hall, Los Angeles, Calif. App. filed Aug. 2, 1924.

1,699,019. ELECTRICAL CONTROL APPARATUS; C. H. Quinn, San Francisco, Calif. App. filed Dec. 1, 1924.

1,699,024. SPEED-CONTROL SYSTEM FOR ELECTRIC MOTORS; R. Schnitzer, Zurich, Switzerland. App. filed Oct. 25, 1927.

1,699,046. FUSE MOUNTING; G. Carpenter, Newark, N. J. App. filed Sept. 2, 1927.

1,699,058. CIGAR LIGHTER; J. Freud, Chicago, Ill. App. filed Aug. 16, 1926.

1,699,091. KEY-WELDING APPARATUS; W. F. Butler, Hillside, N. J. App. filed Aug. 26, 1927.

New Trade Literature

NICKEL ALLOY STEEL.—"Torsion, Impact and Other Mechanical Properties of SAE-3130 Nickel-Chrome Steel" is the title of bulletin No. 13 issued by the International Nickel Company, Inc., 67 Wall Street, New York City. It contains the results of tests which show that the properties of nickel-chrome steel vary less from heat to heat than those of other commercial steels. The data covering these tests are presented in the form of charts and tables with explanatory comment.

ARC WELDERS AND MOTORS.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-1031A and GEA-1077 which cover the G-E type AW resistor arc welders and the G-E wound-rotor, synchronous squirrel-cage motors for oil pipe-line pumping.

MILLING MACHINES.—The Oesterlein Machine Company, Cincinnati, Ohio, is distributing a catalog which describes and illustrates the Oesterlein tilted offset miller in 48-in. and 28-in. sizes.

MANUAL CONTROLLERS, BRAKES AND PUSH BUTTONS.—Bulletins No. 106-A and No. 108-A issued by the Clark Controller Company, Cleveland, describe and illustrate respectively the type F, form D dynamic braking Clark manual controller, and the Clark "3C" manual controllers. The company also is distributing bulletin No. 109-A covering the Clark "Three C" brakes for alternating current and bulletin No. 110-A describing the Clark "3C" push buttons.

SUBSTATIONS.—The Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, is distributing publication No. 57 which describes and illustrates the new type F high-voltage substation with rotating buses.

AIR PREHEATER.—The Air Preheater Corporation, 25 Broadway, New York City, has issued bulletin No. 129 which covers the Ljungström air preheater. It describes the preheater and gives illustrations of installations. It also includes the discussion of stack temperatures and losses, waste-heat recovery, combustion conditions, fuel-burning equipment, furnace refractories, etc., and their effects upon the performance of high-pressure and medium-pressure boilers and dimension tables of the preheaters, types CNX, CN, CANX and CAN are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Rome, Italy (No. 35,714), for storage batteries for automobiles.

Purchase or agency is desired in Rouen, France (No. 35,779), for household electrical appliances.

An agency is desired in Vienna, Austria (No. 35,711), for household electrical appliances, especially vacuum cleaners and another (No. 35,712), for electrical kitchen appliances for households and hotel use.

An agency is desired in Zurich, Switzerland (No. 35,727), for motor-driven electrical appliances, excepting tools.

Purchase and agency are desired in Montevideo, Uruguay (No. 35,656), for electric pianos.

Purchase and agency are desired in Delhi, India (No. 35,715), for power-plant equipment and electrical supplies.

Purchase is desired in Helsingfors, Finland (No. 35,778), of bare copper wire.

Purchase and agency are desired in Rosario, Argentina (No. 35,775), for electric wiring supplies.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Commercial Plants Comprise 95 per Cent of Total Rating

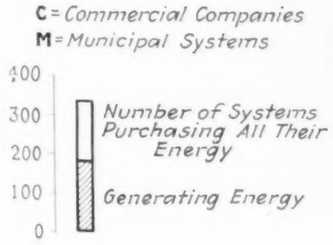
OF THE 31,796,822 kva. in electric light and power stations in the United States at the beginning of 1929, 95.2 per cent was in commercial plants and 4.8 per cent in municipal establishments. The number of establishments in the two groups was nearly equal, 2,153 and 1,910, respectively. Of each group 41 per cent purchased all their energy. But the average size of those generating energy differed greatly. It was 23,750 kva. in the first group and only 1,360 kva. in the second. That is, the commercial systems are, on the whole, much larger than the municipal, and serve a much greater population.

In the densely populated East, as well as in the South and Southwest, large commercial systems greatly predominate. They have a very high percentage of the generating equipment, while the municipal plants are both smaller and fewer.

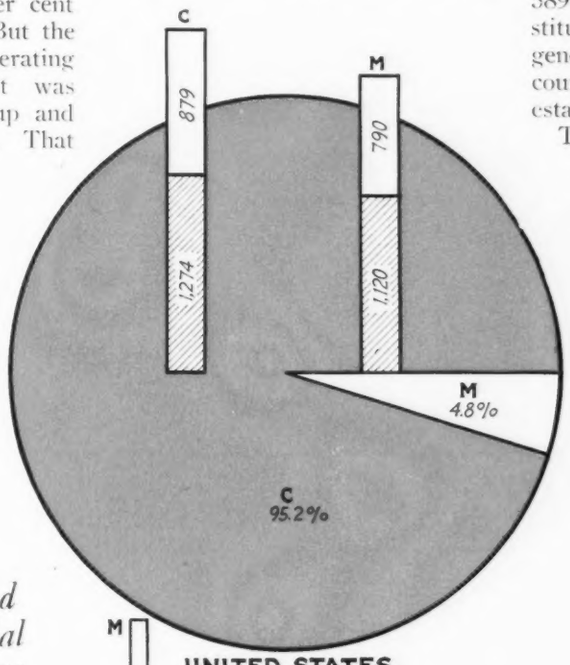
The relative importance of the latter is greatest numerically in the West North Central States, where several hundred small plants serve the widely scattered agricultural centers. The number of systems buying all their energy is notably large in the upper Mississippi Valley, East and West; 481 are municipal; 389 commercial; combined, they constitute over half of the 1,669 non-generating establishments in the country, and over a fifth of all establishments.

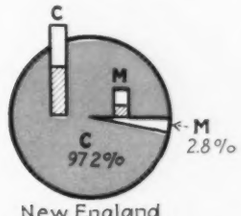
The chart is based on data published in the issue of Jan. 5, 1929, on page 52, where statistics for the individual states may be found.

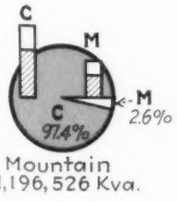
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.

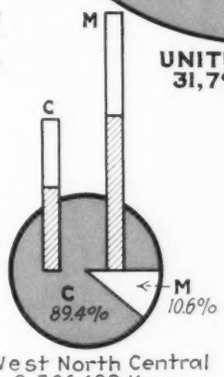


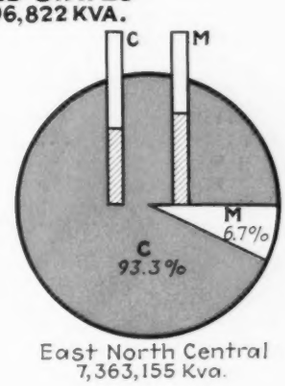
Generator rating and number of commercial and municipal systems

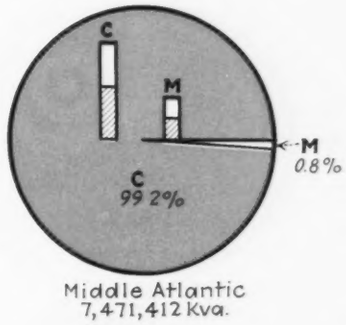


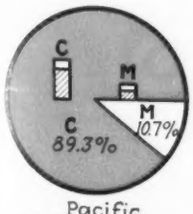


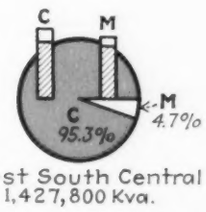


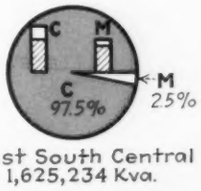


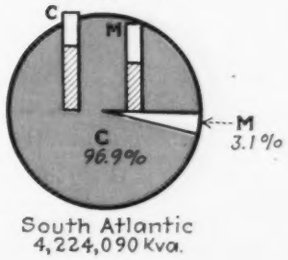












Seasonal Drop in Western Manufacturing

AS WAS to be expected at this season of the year, the manufacturing plants of the Western states recorded a material drop in the rate of activity during December as compared with November, but the December rate of operations was still materially above that of December, 1927. The decrease from November was 15.7 per cent, a slightly more than normal decrease. December increase over the same month in 1927 was 6.1 per cent, the lowest twelve-month gain since August.

The year 1928 as a whole witnessed an average rate of productive operations about 3.7 per cent over 1927, less than one-half the rate of annual increase recorded by American industry in general. The first half of the year witnessed but with one exception activity under that of the same month in 1927, but manufacturing operations during the last half of the year were materially over the same month in the year previous.

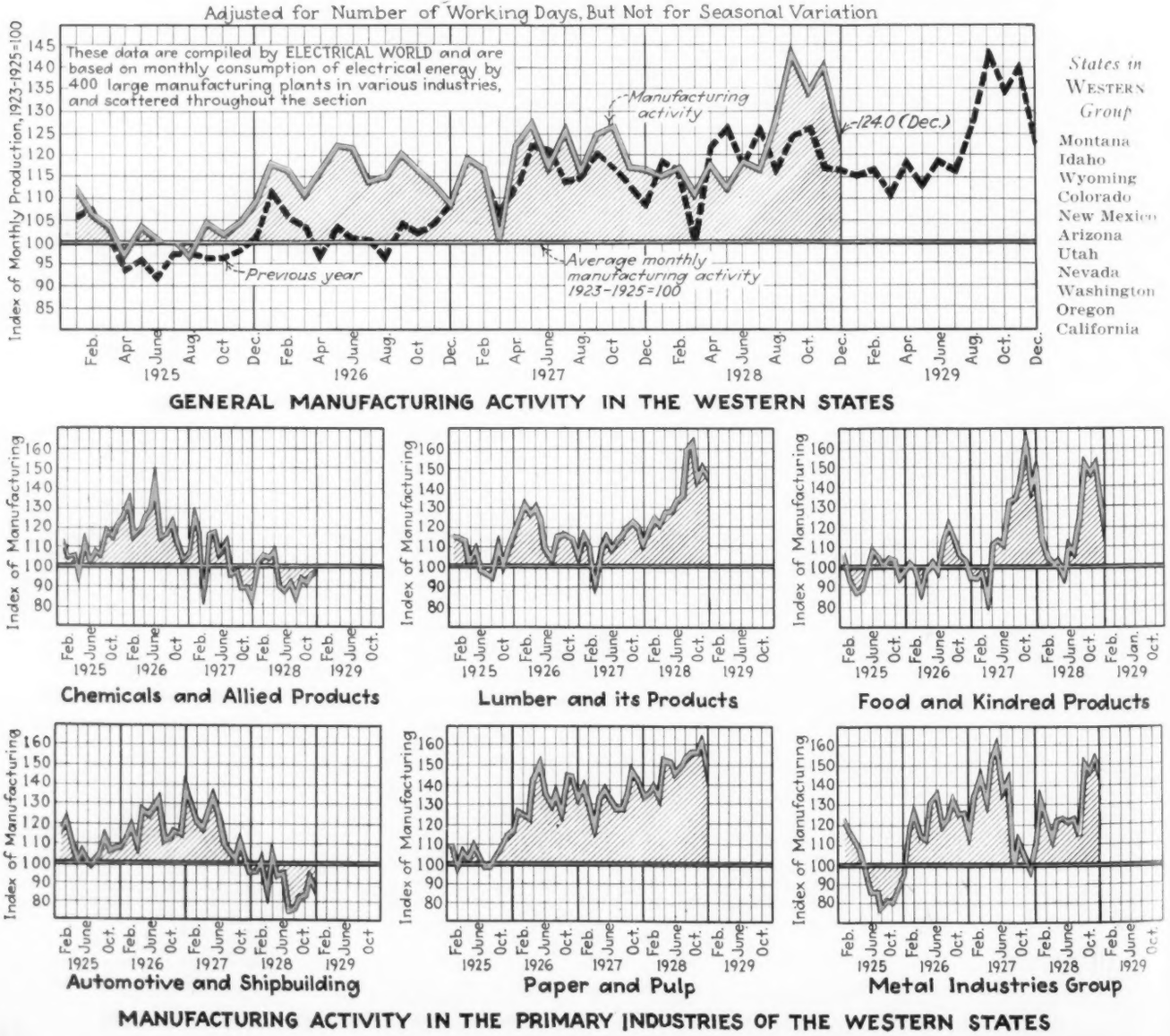
Indexes of Industrial Activity in the Western States
(All Figures Adjusted for Number of Working Days)

	December, 1928	November, 1928	December, 1927	Average for Year 1928	Average for Year 1927
All industry	123.2	140.7	116.9	123.2	118.8
Chemical and allied products	99.7	97.3	84.7	96.8	103.4
Food and kindred products	115.9	152.2	148.5	119.4	123.2
Lumber and its products	143.8	151.0	110.7	137.5	112.4
Metals group	144.0	156.8	108.8	131.9	127.3
Paper and pulp	141.0	162.4	132.4	147.2	133.3
Rubber and its products	142.8	164.2	113.7	154.1	.....
Shipbuilding	85.3	96.2	95.8	83.1	114.6
Stone, clay and glass	128.5	133.6	142.0	140.2	.....

The greatest advances in volume of production by the manufacturing plants of the Western states were made by the lumber and paper industries. The average rate of operations in the lumber industry was 22.4 per cent over 1927 and the paper and pulp industry recorded an average rate of production 10.4 per cent over 1927. The metals group and the rubber products plants also recorded increases over 1927.

On the other hand, four of the primary industrial groups—chemicals and allied products, food and kindred products, shipbuilding, and the stone, clay and glass groups—all recorded an average rate of operations during 1928 under that of 1927.

ELECTRICAL WORLD *Barometer of Industrial Activity in the Western States*


Adjusted for Number of Working Days, But Not for Seasonal Variation
These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Production, 1923-1925=100
Manufacturing activity
124.0 (Dec.)
Previous year
Average monthly manufacturing activity 1923-1925=100
States in Western Group
Montana
Idaho
Wyoming
Colorado
New Mexico
Arizona
Utah
Nevada
Washington
Oregon
California
GENERAL MANUFACTURING ACTIVITY IN THE WESTERN STATES
Chemicals and Allied Products
Lumber and its Products
Food and Kindred Products
Automotive and Shipbuilding
Paper and Pulp
Metal Industries Group
MANUFACTURING ACTIVITY IN THE PRIMARY INDUSTRIES OF THE WESTERN STATES